CT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

CT Pawcatuck River Watershed Bacteria TMDL

FB Environmental and CT DEEP

5/5/2014

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Pawcatuck River and Estuary

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Pawcatuck River watershed covers an area of approximately 4,860 acres in the southeastern corner of Connecticut. The remainder of the watershed is located in Rhode Island. There are several towns located at least partially in the watershed in Connecticut, including the municipalities of Stonington and North Stonington, CT.

The Pawcatuck River watershed includes six freshwater segments and four estuary segments addressed in this TMDL that are impaired for recreation or shellfishing due to elevated bacteria levels. The mainstem segment (CT1000-00_01) was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and first included in the CT 2008 303(d) list of impaired waterbodies. All included freshwater tributary segments were discovered to have elevated bacteria concentrations during targeted monitoring for development of this TMDL. These freshwater tributary streams do not meet water quality standards and will be impaired in the 2014 Integrated Water Quality Report (IWQR) based on results of the data collection in 2011. An excerpt of the IWQR is included in Table 1 to show the status of the waterbodies in the watershed.

The Pawcatuck River begins in South Kingstown, Rhode Island and flows southwest through Richmond, Charleston, Hopkinton, and Westerly, RI, before forming the border between Westerly, RI, and North Stonington, CT. The bacteria impaired freshwater mainstem segment (CT1000-00_01) begins when the river flows into North Stonington, CT (Figure 5). Once the river begins to flow south from North Stonington it forms the border between Westerly, RI, and Stonington, CT. The impaired segment ends at the head of tide at the

Impaired Segment Facts

Impaired Segment:
Segment 1: Pawcatuck River (CT1000-00_01); B; 5.38 miles
Segment 2: Unnamed Brook 1(CT1000-01_01); A; 0.14 miles
Segment 3: Unnamed Brook 2 (CT1000-03_01); A; 0.87 miles
Segment 4: Unnamed Brook 3(CT1000-04_01); A; 0.71 miles
Segment 5: Unnamed Brook 4 (CT1000-05_01); A; 0.55 miles
Segment 6: Unnamed Brook 5(CT1000-00_trib_01); A; 0.17 miles
Segment 7: LIS EB Inner - Pawcatuck River Stonington (*CT-E1_001-SB*); SB; 0.10 miles^2
Segment 8: LIS EB Inner - Pawcatuck River, Stonington (*CT-E1_002-SB*), SB; 0.31 miles^2
Segment 9: LIS EB Shore - Wequetequock Cove, Stonington (*CT-E2_001*), SA; 0.58 miles ^{2}
Segment 10: LIS EB Midshore - Stonington (*CT-E3_001*); SA; 0.61 miles ^{2}

Municipalities: Stonington, North Stonington

Total Impaired River Segment Length (miles): 7.8464

Impaired Estuary Segment Area (miles^2): 1.74

Water Quality Classification: Class A, Class B, SB, SA

Designated Use Impairment: Recreation, Shellfishing

Sub-regional Basin Name and Code: Pawcatuck River CT1000

Regional Basin:
Pawcatuck Main Stem

Major Basin: Pawcatuck

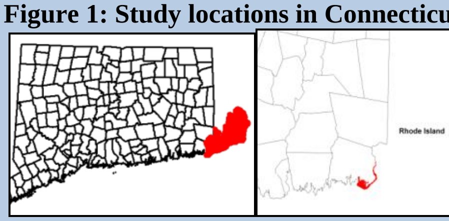
Watershed Area in Connecticut (acres): 4,860

Estuary Area (acres): 1,113

MS4 Applicable: Yes

Applicable Season: Recreation Season (May 1 to September 30) Shellfishing: All year

Figure 1: Study locations in Connecticut



Route 1 crossing in Stonington. The mainstem segment is 5.38 miles long and located in the towns of North Stonington and Stonington, CT.

The freshwater tributaries analyzed for this document connect to the Pawcatuck at various locations on the Connecticut side of the watershed. These streams are all considered unnamed streams. However, in order to improve readability of this document, unofficial names were provided for each stream. This is an effort to help both analysts and end users of the TMDL to differentiate between the segments in the study. Moving from upstream at the Connecticut-Rhode Island border to downstream into the estuary segment the official and un-official named tributary streams are: Unnamed stream 1 (CT1000-01_01) is referred to as Lewis Brook; Unnamed stream 5 (CT1000-00_trib_01) is Iron Brook; Unnamed Stream 2 (CT1000-03_01) is Lassell's Brook; Unnamed Stream 3 (CT1000-04_01) is Kelly Brook; and Unnamed stream 4 (CT1000-05_01) is Hyde Brook.

Lewis Brook (CT1000-01_01) is 0.14 miles long and has some agricultural land use in its immediate watershed. Iron Brook (CT1000-00_trib_01) is a 0.178 mile long segment flowing near a secondary highway. Lassell's Brook (CT1000-03_01) is the longest tributary evaluated for the TMDL at 0.876 miles long and covers a generally residential area. Kelly Brook (CT1000-04_01) is 0.719 miles in length and covers similar land use patterns as Lassell's Brook. Hyde Brook (CT1000-05_01) is 0.55 miles long and covers the most densely residential and commercial land use of the group of tributaries included in this TMDL document.

The Pawcatuck Estuary (Estuary 1) covers an area of approximately 1,113 acres in the southeastern corner of Connecticut and includes four bacteria impaired segments for Connecticut, which are located in the eastern portion of Long Island Sound (LIS). The impaired segments in this summary are located in the municipality of Stonington, CT. Two segments are impaired for commercial shellfish and two segments are impaired for direct shellfish consumption, all are due to elevated bacteria levels. Many segments in the estuary are unassessed for recreation; this doesn't mean the segment has no potential issues, just an indication that current data is lacking to evaluate recreational use as part of an assessment process. These segments were assessed by CT DEEP and included in the CT 2012 303(d) List of Impaired Waterbodies. An excerpt of the Integrated Water Quality Report is included in Table 1 (CT DEEP, 2012).

Connecticut Impaired Segments

Segment 1: The freshwater impaired segment of the Pawcatuck River (CT1000-00_01) has a water quality classification of B. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Pawcatuck River, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 2: The freshwater impaired segment, Lewis Brook (CT1000-01_01) has a water quality classification of A. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Lewis Brook, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 3: The freshwater impaired segment, Lassell's Brook (CT1000-03_01) has a water quality classification of A. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Lassell's Brook, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 4: The freshwater impaired segment, Kelly Brook (CT1000-04_01) has a water quality classification of A. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Kelly Brook, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 5: The freshwater impaired segment, Hyde Brook (CT1000-05_01) has a water quality classification of A. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Hyde Brook, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 6: The freshwater impaired segment, Iron Brook (CT1000-00_trib_01) has a water quality classification of A. Designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches in this segment of the Iron Brook, the specific impairment is recreation for non-designated swimming and other contact water-related activities.

Segment 7: LIS EB Inner – Pawcatuck River (CT-E1_001-SB) is part of the eastern portion of LIS. It includes the inner estuary of the Pawcatuck River from Stanton Weir Point upstream to Saltwater limit, parallel to Rail Road and Mechanic Street, Clarks Village, (Stonington) (Figure 3).

Segment 8: LIS EB Inner-Pawcatuck River (CT-E1_002-SB) is part of the eastern portion of LIS. This segment included the inner estuary of the Pawcatuck River from the mouth at Pawcatuck Point, upstream to Stanton Weir Point (Stonington) (Figure 3).

Impaired segments seven and eight of the Pawcatuck Estuary have a water quality classification of SB. Designated uses include commercial shellfish harvesting, recreation, habitat for marine fish and other aquatic life and wildlife, industrial water supply, and navigation. Segment 7 (CT-E1_001-SB) is impaired for both commercial shellfish harvesting and recreation uses due to elevated bacteria concentrations, while Segment 8 (CT-E1_002-SB) of the estuary is only impaired for the designated use of commercial shellfish harvesting.

Segment 9: LIS EB Midshore - Stonington (CT-E2_001) is located in the eastern portion LIS from rail road crossing on the east side of Wequetequock Cove to the mouth of the Pawcatuck River, out approximately 1000 ft offshore (Little Narragansett Bay).

Segment 10: LIS EB Shore - Wequetequock Cove, Stonington (CT-E3_001) is located in the eastern portion of LIS from approximately 1000 ft offshore (Little Narragansett Bay), out to the CT/NY state line.

These impaired segments (Segments 9-10) of the Pawcatuck Estuary have a water quality classification of SA. Designated uses include shellfish harvesting for direct human consumption, recreation, habitat for marine fish and other aquatic life and wildlife, industrial water supply, and navigation. These segments of the estuary are impaired due to elevated bacteria concentrations, affecting the designated use of shellfishing.

Segment CT-E1_001-SB is a segment that also was recently impaired for recreation due to elevated enterococci results submitted via RIDEM from Save the Bay. The impairment listing is included in the 2012 CT IWQR. The map in figure 4, highlights the monitoring stations utilized to impair the segment. Results and reductions are included in this TMDL document in table 16.

In addition to the tributaries listed as segments in this TMDL, the Shunock River also flows into the Pawcatuck River. The Shunock is also impaired for recreation use and a TMDL was drafted and approved by EPA in September 2012. Therefore TMDL reduction goals have already been calculated for the Shunock River. The complete document is viewable at this linked page http://www.ct.gov/deep/lib/deep/water/tmdl/statewidebacteria/shunockriver1004.pdf.

Table 1: Impaired segments and nearby waterbodies in the Pawcatuck Sub-Regional Basin and Estuary based onthe Connecticut 2012 Integrated Water Quality Report and additional sampling information.

Waterbody ID	Waterbody Name	Location	Square Miles	Marine/ Aquatic Life	Recreation	Direct Shellfish	Commercial Shellfish	Fish Consumption
CT1000-00_01	Pawcatuck River-01	From head of tide, Rte 1 crossing in Pawcatuck, CT - Westerly, Upstream to RI border.	5.38 (linear miles)	FULL	NOT	///	///	FULL
CT1000-01_01*	Unnamed Brook 1 Lewis Brook	From the mouth of Lewis Brook into the Pawcatuck River to the outfall of Lewis Pond	0.14 (linear miles)	U	NOT	///	///	U
CT1000-05_01*	Unnamed Brook 4 Hyde Brook	From mouth of Hyde Brook into the Pawcatuck to the outfall of an unnamed pond	0.55 (linear miles)	U	NOT	///	///	U
CT1000-04_01*	Unnamed Brook 3 Kelly Brook	From mouth of Kelly into Pawcatuck River upstream to wetlands complex source	0.71 (linear miles)	U	NOT	///	///	U
CT1000-03_01*	Unnamed Brook 2 Lassell's Brook	From the mouth of Lassell's Brook into the Pawcatuck upstream to source at Elmridge Road	0.87 (linear miles)	U	NOT	///	///	U

Waterbody ID	Waterbody Name	Location	Square Miles	Marine/ Aquatic Life	Recreation	Direct Shellfish	Commercial Shellfish	Fish Consumption
CT1000-00_trib_01*	Unnamed Brook 5 Iron Brook	From mouth of Iron Brook into the Pawcatuck River to the outfall of an unnamed pond	0.17 (linear miles)	U	NOT	///	///	U
CT-E1_001-SB	LIS EB Inner - Pawcatuck River (01), Stonington	Eastern portion of LIS, Inner Estuary in Pawcatuck River from Stanton Weir Point US to Saltwater limit, parallel to RR and Mechanic Street, Clarks Village, (Stonington).	0.10	NOT	NOT	///	NOT	FULL
CT-E1_002-SB	LIS EB Inner - Pawcatuck River (02), Stonington	Eastern portion of LIS, Inner Estuary in Pawcatuck River from mouth at Pawcatuck Point, upstream to Stanton Weir Point.	0.31	FULL	U	////	NOT	FULL
CT-E1_003	LIS EB Inner - Inner Wequetequock Cove, Stonington	Eastern portion of LIS, Inner Estuary, Inner Wequetequock Cove from RR crossing upstream to Saltwater limit, in two lopes adjacent to Route 1, Stonington	0.09	U	U	NOT	///	FULL
CT-E1_004-SB	LIS EB Inner - Outer Stonington Harbor, Stonington	Eastern portion of LIS, Inner Estuary, Outer Stonington Harbor from SB/SA water quality boundary near Wamphassuc Point to offshore Stonington Point, upstream to RR crossing, Stonington.	0.63	U	FULL	////	FULL	FULL
CT-E1_005	LIS EB Inner - Inner Stonington Harbor, Stonington	Eastern portion of LIS, Inner Estuary, Inner Stonington Harbor from SB/SA water quality boundary at RR crossing, upstream to Saltwater limit near Route 1	0.22	FULL	FULL	NOT	////	FULL

Waterbody ID	Waterbody Name	Location	Square Miles	Marine/ Aquatic Life	Recreation	Direct Shellfish	Commercial Shellfish	Fish Consumption
CT-E1_006	LIS EB Inner - Inner Quiambaug Cove, Stonington	Eastern portion of LIS, Inner Estuary, Inner Quiambaug Cove from RR crossing, upstream to Saltwater limit, above Route 1 crossing, adjacent to Cove Road, Stonington.	0.11	U	U	NOT	////	FULL
CT-E1_007-SB	LIS EB Inner - Mystic River (Mouth), Stonington	Eastern portion of LIS, Inner Estuary, Mouth of Mystic River Estuary from RR crossing, upstream to Saltwater limit, above Route 95 crossing, adjacent to Mill Street, Stonington (Old Mystic).	0.45	FULL	FULL	////	FULL	FULL
CT-E2_001	LIS EB Shore - Wequetequock Cove, Stonington	Eastern portion of LIS from RR crossing on east side of Wequetequock cove to mouth of Pawcatuck River, out approximately 1000 ft offshore (Little Narragansett Bay).	0.61	FULL	FULL	NOT	////	FULL
CT-E2_002	LIS EB Shore - Stonington Point, Stonington	Eastern portion of LIS from Stonington Point to RR crossing on west side of Wequetequock Cove, out approximately 1000 ft offshore.	0.66	U	U	NOT	////	FULL
CT-E2_003	LIS EB Shore - Outer Quiambaug Cove, Stonington	Eastern portion of LIS from Mouth of inner Quiambaug Cove at RR crossing to SB/SA water quality boundary at mouth of Stonington Harbor, out approximately 1000 ft offshore	0.38	U	U	NOT	////	FULL

Waterbody ID	Waterbody Name	Location	Square Miles	Marine/ Aquatic Life	Recreation	Direct Shellfish	Commercial Shellfish	Fish Consumption
CT-E2_004	LIS EB Shore - Wilcox Cove (Mason Is.), Stonington	Eastern portion of LIS from tip of Mason Island to Mouth of inner Quiambaug Cove, out approximately 1000 ft offshore.	0.69	U	U	NOT	////	FULL
CT-E2_005	LIS EB Shore - Mouth Mystic River, Stonington	Eastern portion of LIS from western most tip of Mason Island along SB/SA water quality boundary to eastern most tip of Mason Island, out approximately 1000 ft offshore.	0.35	FULL	FULL	NOT	////	FULL
CT-E3_001	LIS EB Midshore - Stonington	Eastern portion of LIS from approximately 1000 ft offshore (Little Narragansett Bay), out to CT/NY State line.	0.58	U	U	NOT	////	FULL
CT-E3_002	LIS EB Midshore - Stonington Harbor	Eastern portion of LIS from approximately 1000 ft offshore, Enders Island to Stonington Point, out to CT/NY State line.	4.41	U	U	FULL	////	FULL

Shaded cells indicate segments addressed in this TMDL

FULL = Designated Use Fully Supported

NOT = Designated Use Not Supported

/// = Not Applicable to Segment U = Unassessed

*** Segment not currently included in 2012 IWQR but will be impaired in 2014 IWQR based on recent DEEP data**

Rhode Island Impaired Segments

The Pawcatuck River and estuary are interstate waters and form the boundary between Connecticut and Rhode Island. This TMDL focuses primarily on the Connecticut impaired segments and reductions. Rhode Island segments and impairments are provided for informational purposes in this TMDL document. A Rhode Island TMDL for the estuarine Pawcatuck River, Watch Hill Cove, and Little Narragansett Bay was completed in 2010 and is available at http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/lnbw.pdf. The 2010 TMDL also included Mastuxet Brook, a freshwater tributary to the estuarine Pawcatuck River. In 2011, Rhode Island completed a Statewide Bacteria TMDL, which included sixteen impaired segments in the Pawcatuck River watershed. Recently, Rhode Island has drafted three waterbody summaries to amend its 2011

Statewide Bacteria TMDL. These new waterbody summaries address bacteria impairments to its two upstream freshwater Pawcatuck River segments, not the segment that forms the Rhode Island and Connecticut border. The third summary addresses bacteria impairments on Spring Brook, a tributary to the furthest downstream freshwater Pawcatuck River segment. Implementation efforts based on the recommendations in this CT TMDL document and the Rhode Island TMDL documents will help achieve water quality standards for both states in the Pawcatuck Watershed.

Table 2. Rhode Island Impaired Segments and Water Quality Classifications in and adjacent to the Study Area

Waterbody ID	Waterbody Description	Water Quality Classification	Size	Impairments	Pathogen TMDL Date
RI0008039R-02A	Ashaway River[1]	A	1.8 mi	Enterococci, Cadmium	2011
RI0008039R-41	Spring Brook[1]	B	2.41 mi	Enterococci	2014
RI0008039R-11	Mastuxet Brook[1]	B	2.641 mi	Enterococci Fecal Coliform	2010
RI0008039R-18D	Pawcatuck River: Bradford Dyeing Associates to Route 3 Bridge	B1	5.529 mi	Enterococci, Benthic-Macroinvertebrate, Bioassessments	2014
RI0008039R-18E	Pawcatuck River: Route 3 Bridge to Route 1 Highway Bridge	B	11.36 mi	Enterococci, Iron, Lead, Non-Native Aquatic Plants	2014
RI0008038E-01A	Tidal Pawcatuck River: Route 1 Highway Bridge to Pawcatuck Rock	SB1	0.3211 mi^2	Fecal Coliform, Dissolved Oxygen	2010
RI0008038E-01B	Tidal Pawcatuck River: Pawcatuck Rock to Pawcatuck Point	SB	0.6889 mi^2	Fecal Coliform	2010
RI0008038E-02A	Little Narragansett Bay	SA	0.7893 mi^2	Fecal Coliform	2010
RI0008038E-02B	Little Narragansett Bay: Watch Hill Cove and area north of Napatree	SA{b}	0.3081 mi^2	Fecal Coliform	2010

[1]The Ashaway River and Spring Brook are tributaries to segment RI0008039R-18E of the Pawcatuck River, while Mastuxet Brook is a freshwater tributary to RI0008038E-01B of the estuarine Pawcatuck River.

In Rhode Island, the water quality classifications are developed to be protective of varying designated uses, including shellfish harvesting and primary and secondary recreational activities (RIDEM 2010). The following list highlights and details the list of classifications:

- Class SA waters are designated for shellfish harvesting for direct human consumption; primary and secondary contact recreational activities, and fish and wildlife habitat. SA waters shall not exceed a geometric mean of 14 cols/100mls and not more than 10% of samples shall exceed an MPN value of 49 for a 3-tube decimal dilution.
- Class SA{b}have the same designations as SA waters, except that they are in the vicinity of marinas and/or mooring fields and therefore seasonal shellfish harvesting closures may occur in the segment.
- Class SB waters are designated for primary and secondary contact recreational activities, shellfish harvesting for controlled relay and depuration; and fish and wildlife habitat. SB waters shall not exceed a geometric mean of 50 cols/100mls and not more than 10% of samples shall exceed an MPN value of 400 for a 3-tube decimal dilution.

- Class SB1 are the same as Class SB waters, except that primary contact activities may be impacted due to approved wastewater discharges.
- Class B waters are designated for primary and secondary contact recreational activities and fish and wildlife habitat. B waters shall not exceed a geometric mean of 200 cols/100mls and not more than 10% of samples shall exceed an MPN of 400 for a 3-tube decimal dilution.

Rhode Island has also completed two additional Pawcatuck TMDL documents on the freshwater portions of the waterbody. The documents are available at http://www.dem.ri.gov/programs/benviron/water/quality/swbtmdl.htm under the Wood-Pawcatuck Rivers section. The included segments are both on the mainstem of the Pawcatuck River and are RI0008039R-18B and RI0008039R-18C, respectively, in order from upstream to downstream. These two segments are entirely within Rhode Island and do not include the section of the Pawcatuck River directly upstream of the Connecticut border, nor the shared freshwater segment between the two States. For freshwater segments, RIDEM has developed Water Quality Regulations that contain water quality criteria for enterococci of a geometric mean of 54 colonies/ 100mL for non-designated bathing beaches. Both of the Pawcatuck River segments mentioned in this paragraph exhibited exceedances of the Rhode Island water quality criteria.

CT DEEP doesn't utilize enterococci bacteria as an indicator for recreation use for freshwater segments. However, during the sampling for this TMDL document, a limited data set was collected on the freshwater tributaries and the Pawcatuck mainstem. CT DEEP staff collected sample bottles at the Connecticut stations and delivered the bottles to RIDEM staff for analysis at the HEALTH Laboratory for the enterococci analysis. CT DEEP staff also collected samples for e.coli analysis on these same sampling trips and analyzed the samples at the CT Department of Public Health laboratory in Rocky Hill. The enterococci data is displayed in Appendix 1 at the end of this TMDL document.

The results of the sampling show elevated levels of enterococci at most sample collection locations. CT DEEP has no comparative criteria in the CT WQS for enterococci for freshwater streams. Rhode Island utilizes single sample maximum criteria of 61 cols/100mls and a geometric mean of 54 cols/100mls for non-designated bathing beaches. The data shows that all of the monitored tributaries are contributing enterococci loads to the mainstem of the Pawcatuck River. CT DEEP has included TMDL reductions for e.coli on the freshwater border segment (CT-1000-00_01) and the freshwater tributaries in this document. It is assumed that these reductions, when achieved, will also provide protection for the enterococci criteria that Rhode Island utilizes to determine water quality.

Figure 2. CT DEEP and RIDEM staff during coordinated sampling trip

Figure 3: GIS map of impairments and station locations for estuary segments included in this TMDL

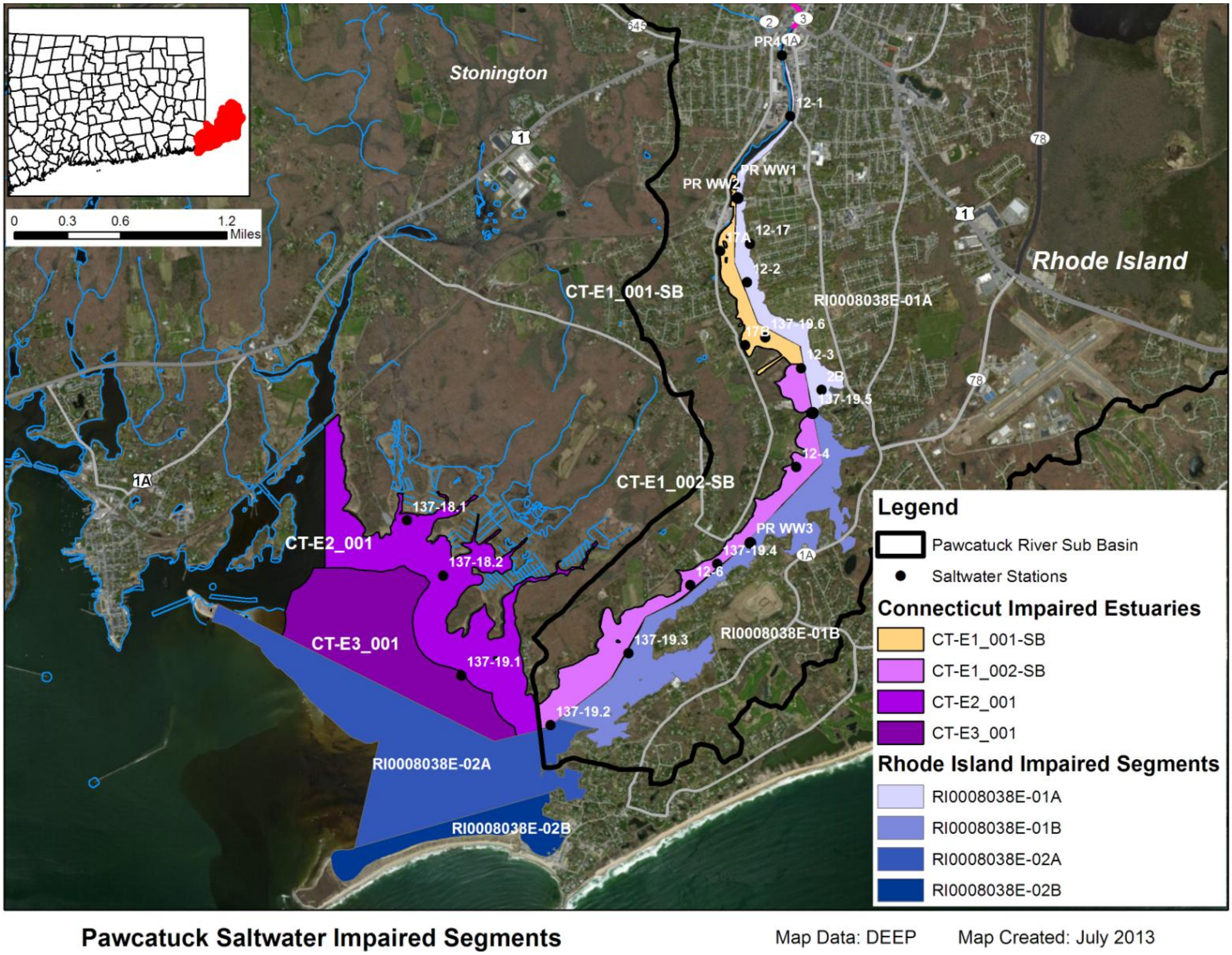


Figure 4. Close up map of Recreation Impaired Estuary (E1_001-SB) featuring sampling stations

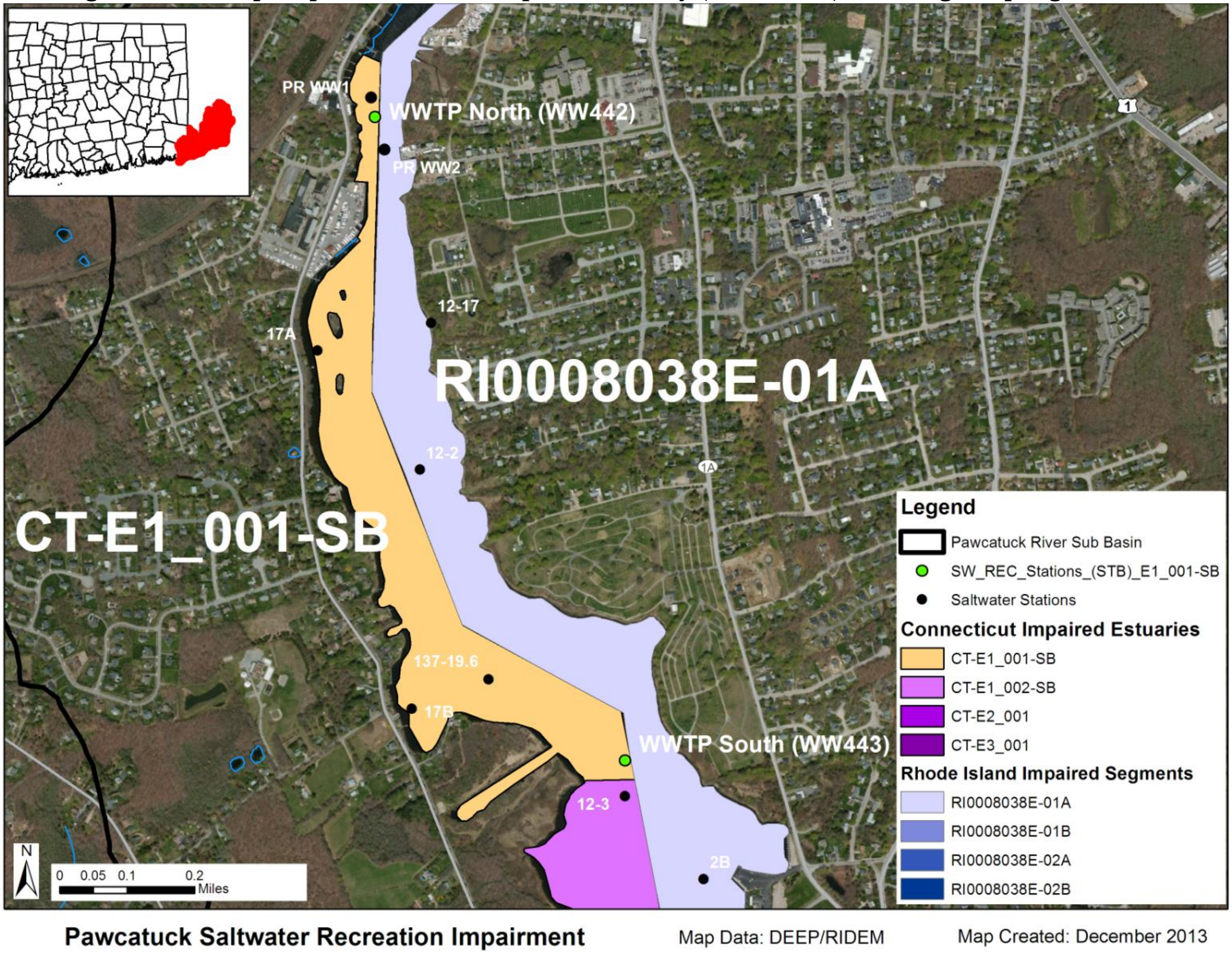
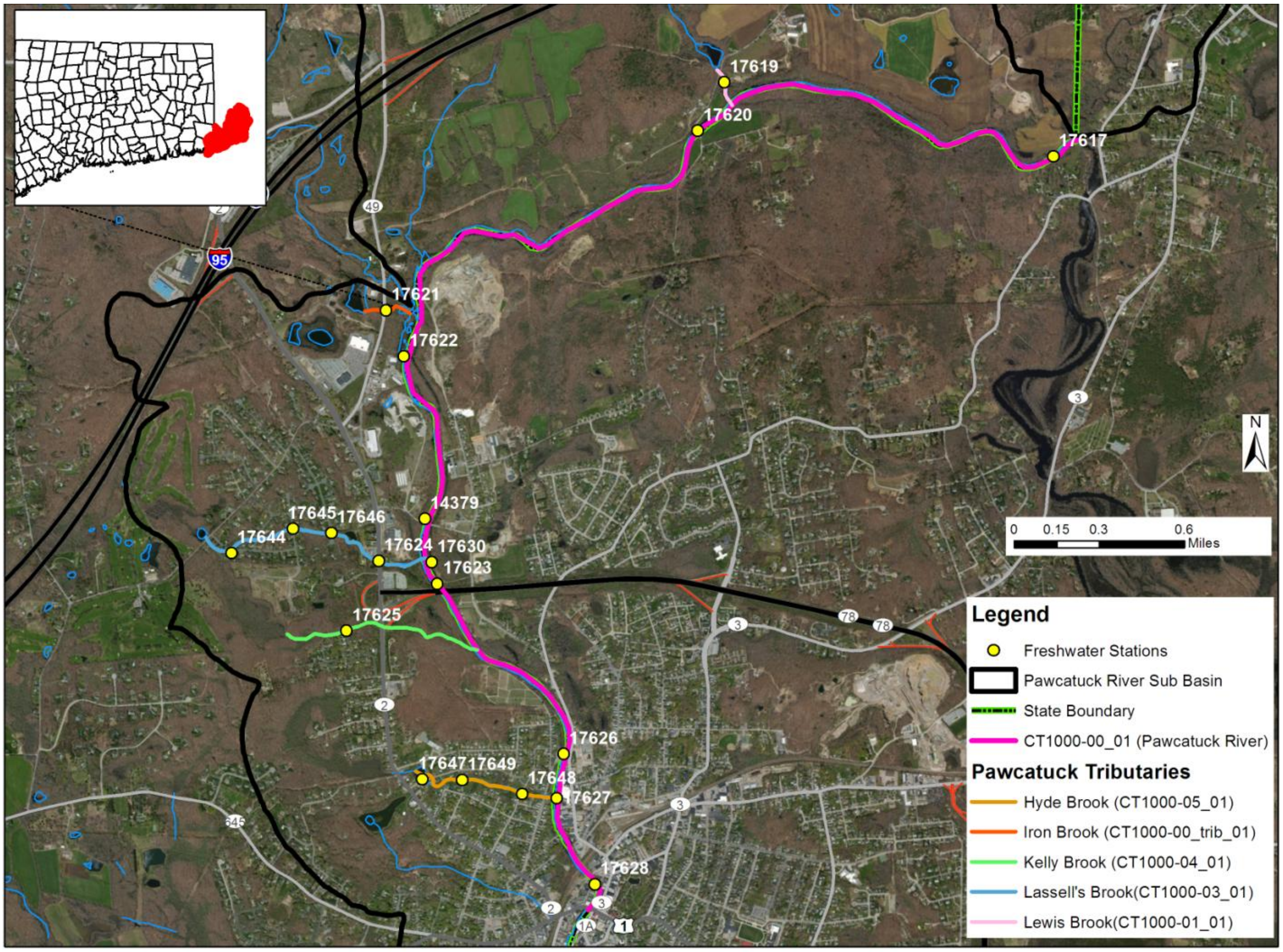


Figure 5. GIS map featuring impairments and station locations of Freshwater segments



Freshwater Impairments Pawcatuck River Map Data: DEEP Map Created: October 2013

Land Use

The existing land use in a watershed can affect the water quality of the waterbodies within that watershed (USEPA, 2011c). In an undeveloped watershed, natural processes such as infiltration of stormwater into the soil and plant uptake of water and nutrients can occur. As watersheds become more developed with commercial, residential, and industrial land uses, the amount of stormwater runoff increases as the natural landscape is altered with impervious surfaces, such as rooftops, roads, and sidewalks. The amount of pollutants, such as nutrients and bacteria from leaking septic systems, oil and grease from automobiles, and sediment from construction activities, can also increase, can become entrained in this runoff, and negatively affect nearby waterbodies. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 6 and 7, the Pawcatuck River watershed consists of 17% urban area, 73% forest, 6% agriculture, and 4% water. The majority of the watershed is comprised of forested land use. This is due to heavy forested land use in the Rhode Island portion of the watershed closer to the headwaters of the watershed. The lower part of the watershed, in both states, is more heavily urban land use which may have a more direct impact on the Pawcatuck mainstem water quality. There are several large agricultural areas in the watershed adjacent to the Pawcatuck River in North Stonington (Figure 7).

Figure 6: Land uses within the entire Pawcatuck River watershed

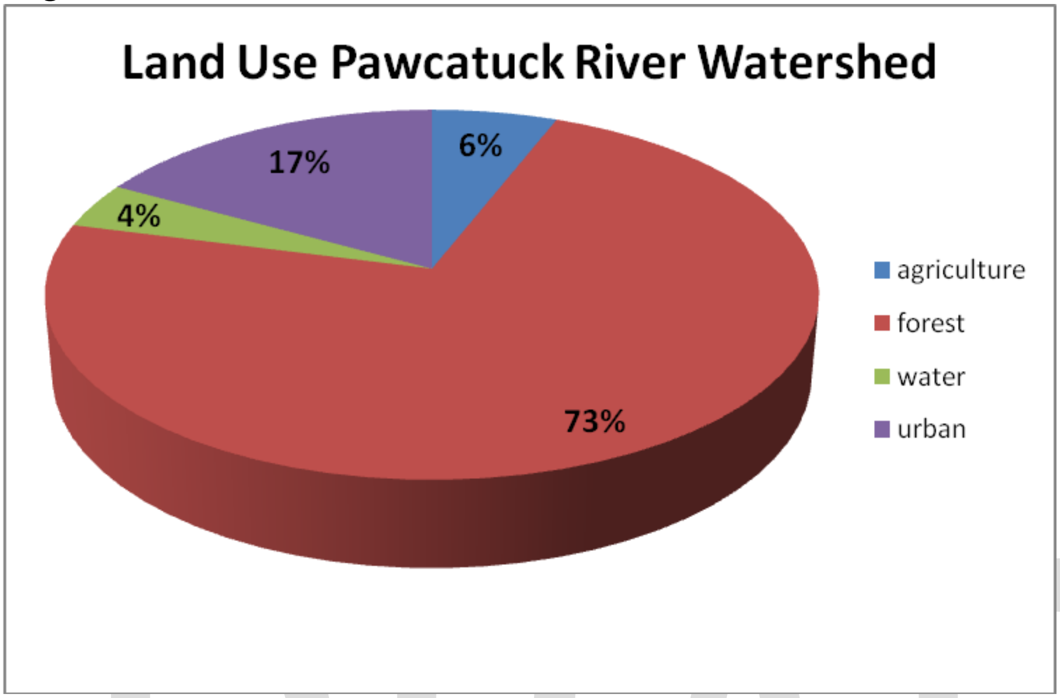
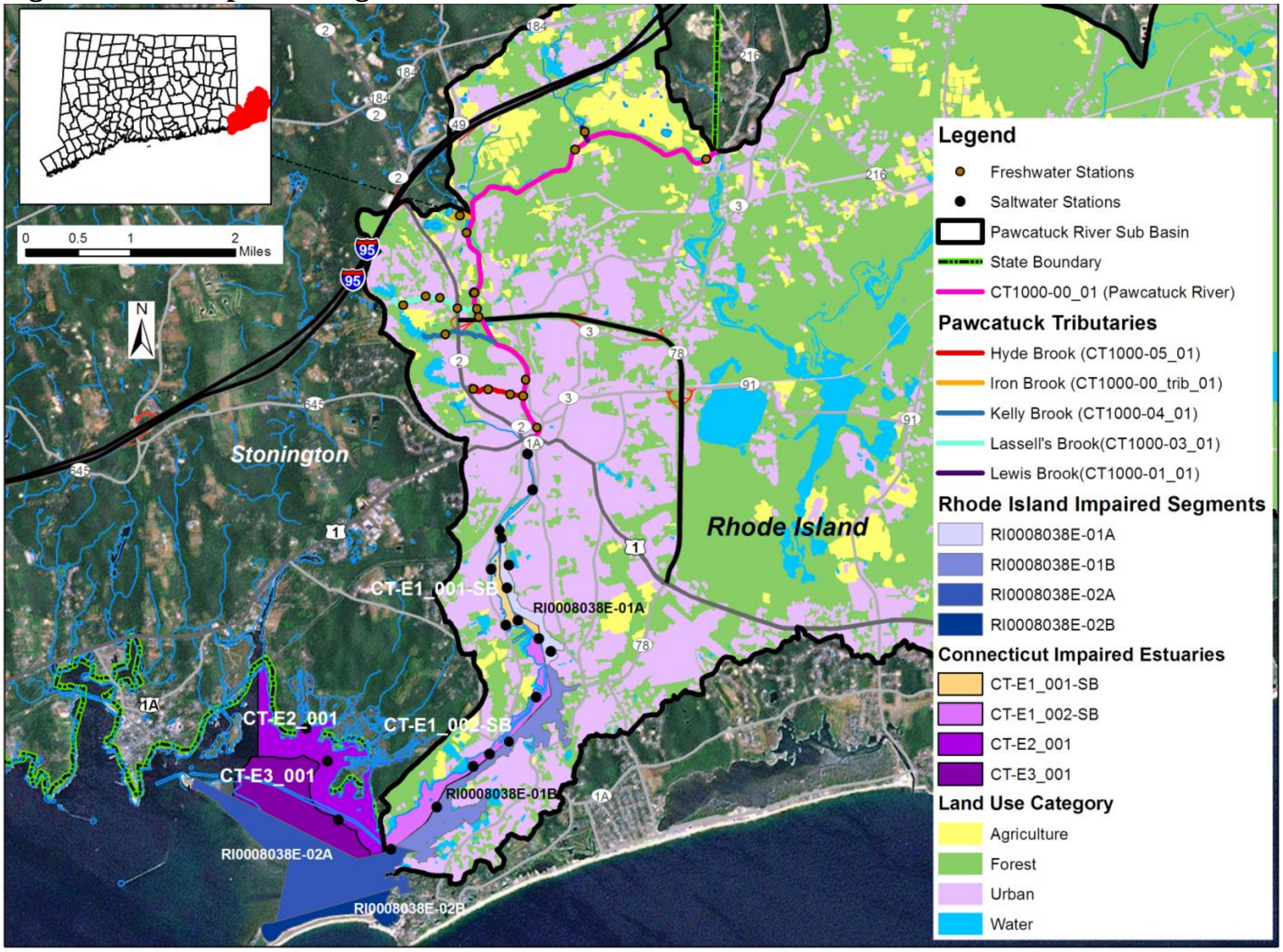


Figure 7: GIS map featuring land use for the Pawcatuck River watershed



Land Use In The Pawcatuck River Sub Regional Basin Map Data: DEEP Map Created: October 2013

Shellfish Bed Classifications, Closures, and Lease Locations

The Connecticut Department of Agriculture/Bureau of Aquaculture (CT DA/BA) is responsible for regulating shellfish harvesting (http://www.ct.gov/doag/cwp/view.asp?a=1369&Q=259170). A shellfish growing area is defined by CT DA/BA as any area that supports or could support the growth and/or propagation of molluscan shellstock. Shellfish are defined by CT DA/BA as oysters, clams, mussels, and scallops, either shucked or in the shell, fresh or frozen, whole or roe-on. All shellfish growing areas are classified by CT DA/BA in accordance with the Interstate Shellfish Sanitation Conference (ISSC) National Shellfish Sanitation Program Model Ordinance (NSSP-MO) and CT General Statutes Chapter 491, §26-192e. These classifications, summarized below, are established to minimize health risks and may restrict the take and use of shellfish from some areas. They are based on fecal coliform bacteria standards as provided in the NSSP-MO (Interstate Shellfish Sanitation Conference, 2007). Any shellfish area, regardless of classification, may be temporarily closed to all activities when a potential public health emergency exists as a result of a storm event, flooding, sewage, chemical, or petroleum discharges, or a hazardous algal bloom.

Shellfish harvesting has been divided into two designated uses as specified in the Connecticut WQS: shellfish harvesting suitable for direct human consumption (Class SA waters), and shellfish harvesting suitable for commercial operations requiring depuration or relay (Class SB waters). These classifications are goals for the waterbody segments and set the goals for water quality. These uses determine the water quality criteria that are the target for each segment. The impaired segments in the Pawcatuck Estuary include both Class SA and SB waters.

Shellfish Bed Classifications and Closures in the Pawcatuck Estuary

Shellfish classification areas in the Pawcatuck Estuary are shown in Figure 8. The following classifications for shellfish growing areas are defined by CT DA/BA:

APPROVED AREA: Is a classification used to identify a growing area that is safe for the direct marketing or consumption of shellfish. An area may be classified as Approved when a sanitary survey finds that there is no contamination from pathogenic organisms, poisonous or deleterious substances, marine biotoxins, or bacteria concentrations exceeding the bacteriological standards for a growing area in this classification as set forth in the NSSP MO. The water quality in the growing area shall also meet the bacteriological standards for an Approved classification.

CONDITIONALLY APPROVED AREA: Is a classification used to identify a growing area that is safe for the direct, marketing or consumption of shellfish when the area is in the open status. The area must meet the criteria for Approved classification when the area is in the open status, and meets the criteria for the restricted classification in the closed status. An area may be classified as Conditionally Approved when a sanitary survey finds that the area can remain in the open status for a reasonable period of time, the factors impacting the area are known and predictable and do not preclude a reasonable management approach, and the water quality correlates with the environmental conditions or other factors affecting the distribution of pollutants into the growing area. Each Conditionally Approved growing area must have a written management plan that is adhered to by all responsible parties.

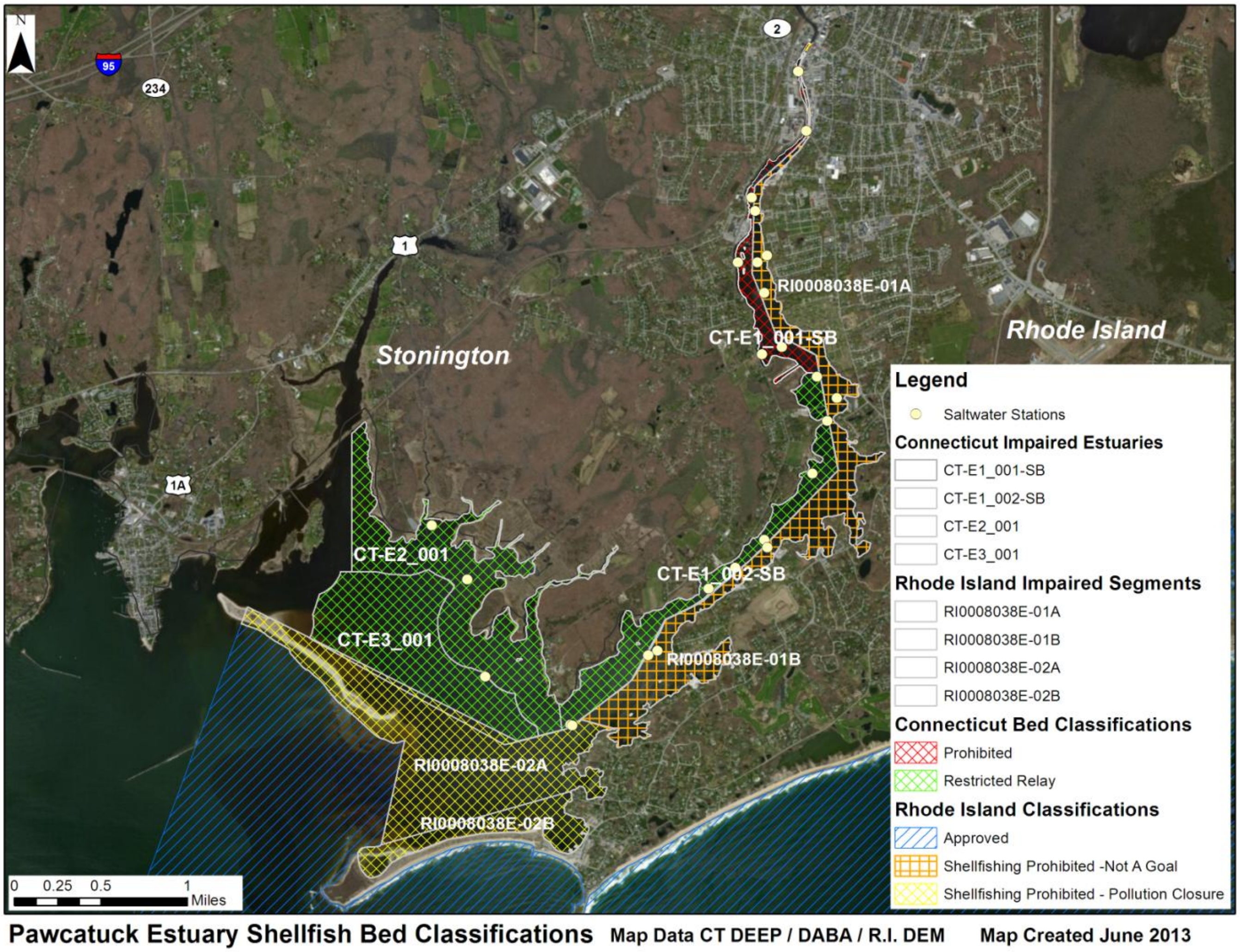
RESTRICTED RELAY/DEPURATION: Is a classification used to identify a growing area where harvested shellstock is relayed to Approved or Conditionally Approved waters for natural cleansing or depuration*. An area may be classified as Restricted Relay when a sanitary survey finds a limited degree of pollution and levels of fecal pollution, human pathogens, or poisonous or deleterious substances so that shellstock can be made safe for human consumption by either relaying, depuration or low acid-canned food processing. Shellfish may only be harvested from restricted areas by special license, and may not be directly harvested for market or consumption.

*Depuration means the process of reducing the pathogenic organisms that may be present in shellstock by using a controlled aquatic environment as the treatment process.

CONDITIONALLY RESTRICTED: Is a classification used to identify a growing area where a sanitary survey has found that the area meets the criteria for Restricted classification when the area is in the open status and meets the criteria for Prohibited classification when the area is in the closed status. Each Conditionally Restricted growing area must have a written management plan that designates whether harvested shellfish are relayed or depurated. Shellfish may only be harvested from Conditionally Restricted areas by special license, and may not be directly harvested for market or consumption**.**

PROHIBITED: Is a classification used to identify a growing area where there has been no current sanitary survey or where a sanitary survey has found that the area is adjacent to a sewage treatment plant or other point source outfall with public health significance; pollution sources may unpredictably contaminate the growing area; the growing area is contaminated with fecal waste so that the shellfish may be vectors for disease microorganisms; and/or that the concentration of biotoxin is sufficient to cause a public health risk. Shellfish may not be harvested from Prohibited areas except for seed oystering or depletion of the areas.

Figure 8: GIS map featuring Shellfish Bed Classifications and Closures for the impaired segments in the Pawcatuck Estuary (*Rhode Island has no restricted Relay Classification)



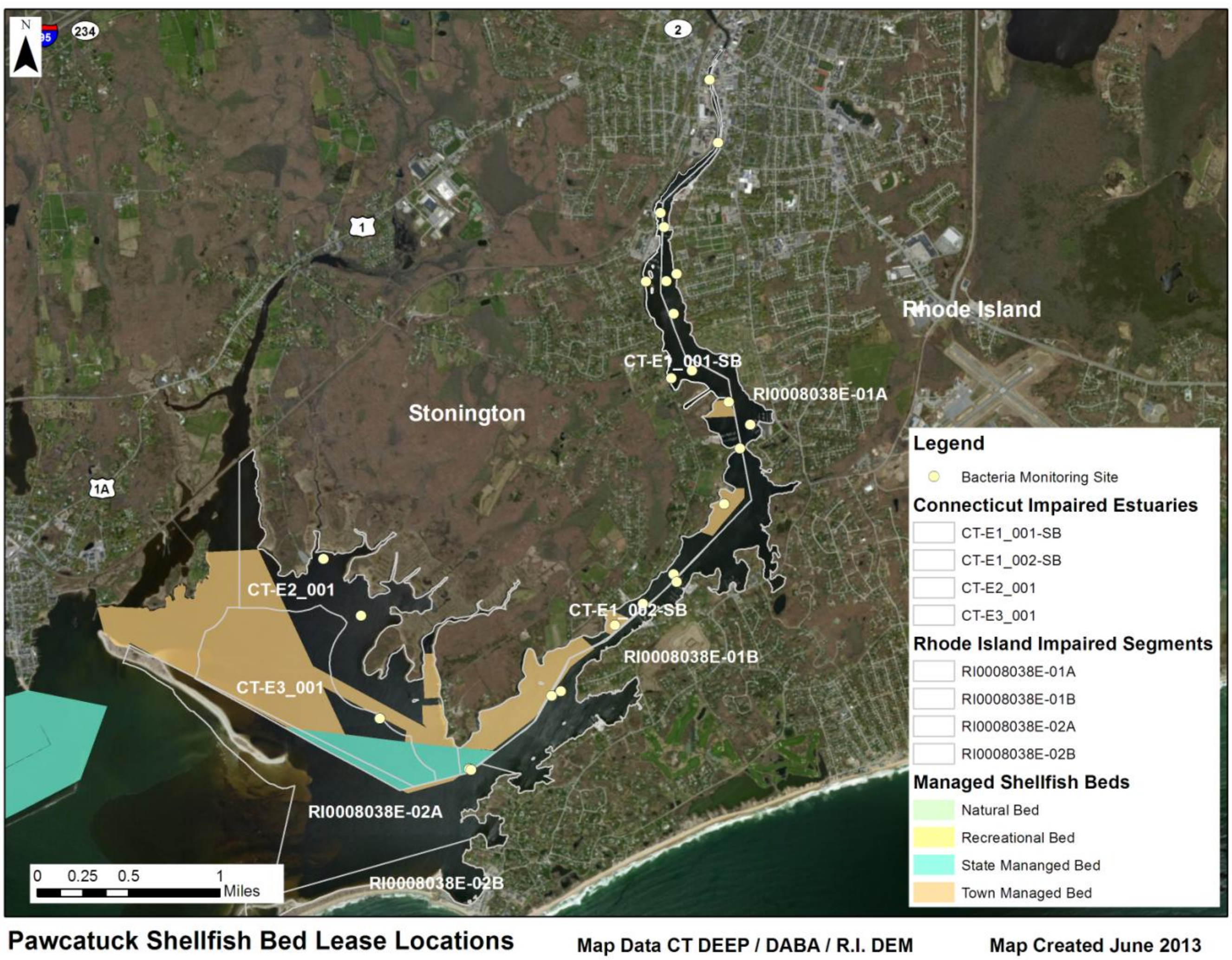
<u>Shellfish Bed Lease Locations</u>

Shellfish beds in the Pawcatuck Estuary are also classified by their management (Figure 9). CT DA/BA defines these areas as follows:

State and Town Beds: In 1881, a line, referred to as the Commissioner's Line, was established to divide the waters of the State into northern and southern sections. All beds south of this line are State beds and most beds north of this line are town beds. Town beds are leased, owned or managed through the local shellfish commission. However, CT DA/BA still controls all the licensing and regulations for both state and town beds. For example, DA/BA issues licenses and determines when an area will be closed to shellfishing due to a change in water quality. Towns may require additional permits to work in waters under local jurisdiction. Beds north of the line in Westport, Milford, West Haven, and New Haven are exceptions to this as they are fully under State control.

State and Town Natural Beds: Natural beds get their name from the fact that shellfish, especially oyster, naturally inhabited the area. These areas tend to be closer to shore, usually at the mouth of a river. Natural beds have specific regulations concerning their use, including licensing and harvesting methods. They are predominately seed beds that cannot be mechanically harvested. Use of natural beds requires a Relay/Transplant License I or II and/or Seed Oyster Harvesting License from CT DA/BA. Any person assisting in the harvesting of seed oysters must have a Helper's License. These beds cannot be leased or subdivided; they are to remain open to any properly licensed harvester. State natural beds are natural beds south of the Commissioner's Line. Descriptions of these beds can be found in §3295 of the Connecticut General Statutes (CGS), revision of 1918. Not all beds listed in §3295 were mapped, and many natural beds in State waters off Greenwich are managed through leases. Town natural beds were defined by law under §2326 of the CGS of 1888. Each town had the opportunity to map areas to be considered natural beds. The documents, written descriptions, and maps were submitted to the Superior Court with jurisdiction for that town. Several towns did not avail themselves to this opportunity, and some have changed the delineation of their natural beds in recent court decisions. There are also areas that may have been declared natural beds, but are now leased.

Figure 9: GIS map featuring Shellfish Bed Lease Locations in the Stonington Estuary



WHY IS A TMDL NEEDED?

E. coli is the freshwater recreational indicator bacteria and fecal coliform is the shellfish indicator bacteria used for comparison with the CT state criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, Rhode Island Department of Environmental Management (RI DEM) or volunteer monitoring efforts at stations located on the impaired segments.

Table 3: Sampling station location description for the impaired segments in the Pawcatuck River watershed and estuary

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT1000-00_01	Pawcatuck River	254/14379	White Rock Road Bridge at state line	Stonington	41.397794	-71.842247
		17617	@Post Office Road	North Stonington	41.41600	-71.799280
		17620	@Boombridge Road	North Stonington	41.41751	-71.823400
		17622	@Alice Court	Stonington	41.406120	-71.843520
		17623	White Rock Road	Stonington	41.394470	-71.841400
		17626	@Stillman Avenue	Stonington	41.385690	-71.832950
		17628	@Coggswell Street	Stonington	41.379000	-71.830950
CT1000-01_01	Lewis Brook	17619	@ Boombridge Road	North Stonington	41.41998	-71.82156
CT1000-03_01	Lassell's Brook	17644	@ Fairview Drive	Stonington	41.396149	-71.855337
		17645	@ Somersett Drive	Stonington	41.397353	-71.851171
		17646	@Timber Ridge Drive	Stonington	41.39685	-71.84755
		17624	Route 2 (Liberty Street)	Stonington	41.39625	-71.84653
CT1000-04_01	Kelly Book	17625	Kelly Road	Stonington	41.39211	-71.82759
CT1000-05_01	Hyde Brook	17647	@ West Arch Street	Stonington	41.384463	-71.842567
		17649	@ Smith Street	Stonington	41.38441	-71.839873
		17648	@ Robinson Street	Stonington	41.383661	-71.835799

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
		17627	@Stillman Avenue Bridge	Stonington	41.3834	-71.83414
CT1000-00_trib_01	Iron Brook	17621	Route 49	Stonington	41.42849	-71.8447
CT-E1_001-SB	LIS EB Inner - Pawcatuck River, Stonington	PR4	Upstream Rhode Island State Boat Ramp	Westerly R.I.	41.3750	-71.8324
		PRWW1	Connors and O'Brien Boatyard	Stonington	41.3648	-71.8376
		PRWW2	Pier 65 Marina	Westerly R.I.	41.3636	-71.8380
		12-1	Mid-channel opposite red brick building marked *1890 CB Cottrell + Sons*, north of rip-rap wall	Westerly R.I.	41.3707	-71.8318
		12-17	From Westerly WWTF plume at outfall	Westerly R.I.	41.3609	-71.8373
		12-2	At Nun Buoy #26	Westerly R.I.	41.3552	-71.8362
		137-19.6	Pawcatuck WWTF	Stonington	41.3522	-71.8348
		17A	Duck Channel West of Major Island	Stonington	41.3575	-71.8388
		17B	South of Gavitt Point, Near Shore	Stonington	41.3516	-71.8370
		WWTP N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	Stonington	41.3644	-71.8372
		WWTP S (WW443)	Pawcatuck River mainstem South of the Treatment plant outfall	Stonington	41.3498	-71.8299
CT-E1_002-SB	LIS EB Inner – Pawcatuck River, Stonington	12-3	At Nun Buoy #20	Stonington	41.3503	-71.8314
		12-4	At Nun Buoy #12	Stonington	41.3415	-71.8318
		12-5/137-19.4	At Nun Buoy #8	Stonington	41.33610	-71.83713
		12-6	At Can Buoy #7	Stonington	41.3320	-71.8433
		12-7	At Nun Buoy #4	Stonington	41.3265	-71.8496
		2B	Westerly Yacht Club Dock F (RI)	Westerly R.I.	41.3479	-71.8289
		12-8/137-19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	Stonington	41.3207	-71.8586
		PRWW3	Frank Hall Boatyard	Westerly RI	41.3354	-71.8367
		19.5	At Stonington-on-the-River	Stonington	41.3460	-71.8299
CT-E2_001	LIS EB Shore-	137-18.1	None	Stonington	41.3376	-71.8740

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
	Wequetequock Cove, Stonington	137-18.2	None	Stonington	41.333	-71.870
CT-E3_001	LIS EB Midshore, Stonington	137-19.1	West of Pawcatuck Point (CT)	Stonington	41.3249	-71.8682

The Pawcatuck River mainstem was sampled at seven sampling locations. Station 254, was sampled during 2006-2009 and 6 additional stations were sampled only in 2011 during a more intensive sampling effort within the basin in support of TMDL development.

All freshwater tributaries to the Pawcatuck River included in this document are Class A streams. Water quality sampling was conducted on the rivers during 2011 in a targeted sampling project for TMDL development. Each of the tributaries had at least one monitoring station, with Hyde Brook and Lassell's Brook having multiple stations.

The water quality criteria for *E. coli*, along with bacteria sampling results from 2006-2009 and the 2011 sampling efforts are presented in Table 15. The annual geometric mean was calculated for Station 254 and exceeded the WQS for *E. coli* in 2007 and 2008. Single sample values at this station also exceeded the WQS for *E. coli* three times in 2006, twice in 2007, four times in 2008, and once in 2009.

The geometric mean for each of the six stations sampled in 2011 along the Pawcatuck River exceeded the WQS for *E. coli*. The single sample WQS was exceeded on three of the twelve sampling dates. These exceedances occurred on the same dates for each station. The first date is 8/15/2011, a wet sampling event, followed by 8/17/2011, a dry event, and the final exceedance on 9/7/2011, another wet event. All other data points on the Pawcatuck River mainstem were below the single sample WQS during the 2011 season.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for all Pawcatuck mainstem stations for wet-weather and dry-weather sampling periods, when possible (Table 15). The wet-weather geometric mean for station 254 exceeded the WQS for *E. coli*. The dry-weather geometric mean did not exceed the WQS for *E. coli*. The wet-weather geometric mean was more than twice the dry-weather geometric mean.

The wet weather geometric mean for all stations in the 2011 sampling run exceeded the WQS for *E. coli*. At two of the stations (17617 and 17620) the dry weather geometric mean did not exceed WQS. The remaining 5 stations did record exceedances for dry weather geometric means during the 2011 sampling efforts.

Due to the elevated bacteria measurements presented in Table 15, this segment of the Pawcatuck River does not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all water bodies to be consistent with with state WQS.

The water quality criteria for *E. coli* along with bacteria sampling results and reduction goals for Lewis Brook (CT1000-01_01) are provided in Table 17. Only one station (17619) was analyzed on the segment and it resulted in a geometric mean of 411 that exceeds the WQS for *E. coli*. There were five sample trips that resulted in exceedances of the single sample WQS for *E. coli*. Further analysis involved a wet weather and dry weather geometric mean calculation. The wet weather and dry weather calculations resulted in an exceedance of WQS.

The water quality criteria for *E. coli* along with bacteria sampling results and reduction goals for Lassell's Brook (CT1000-03_01) are provided in Table 18. Four stations (Table 3) were sampled along the segment and each of these stations resulted in exceedances of the single sample and geometric mean WQS during the 2011 sampling efforts. During the 2011 targeted sampling the largest geometric mean exceedance was 648 cols/100mls and the largest single sample exceedance was 7700 cols/100mls. These results were not from the same station. Further analysis involved a wet weather and dry weather geometric mean calculation for each station. The wet weather and dry weather calculations resulted in exceedances of WQS at every station.

The water quality criteria for *E. coli* along with bacteria sampling results and reduction goals for Kelly Brook (CT1000-04_01) are provided in Table 19. Only one station (17625) was analyzed on the segment and it resulted in a geometric mean of 214 that exceeds the WQS for *E. coli*. There were two sample trips that resulted in exceedances of the single sample WQS for *E. coli*, with the largest value being 4600 cols/100mls. Further analysis involved a wet weather and dry weather geometric mean calculation. The wet weather calculation resulted in an exceedance while the dry weather geometric mean was not above WQS.

The water quality criteria for *E. coli* along with bacteria sampling results and reduction goals for Hyde Brook (CT1000-05_01) are provided in Table 20. There were four stations sampled (Table 3) on the segment and each of these locations resulted in multiple exceedances of the WQS. Each station's dataset also resulted in an exceedance of the geometric mean WQS for *E. coli*. The largest single sample result was 10000 cols/100mls and the largest geometric mean was 1006 cols/100mls. Further analysis involved a wet weather and dry weather geometric mean calculation for each station. The wet weather and dry weather calculations resulted in exceedances of WQS at all stations, except 17647 where the dry weather geometric mean was not above WQS.

The water quality criteria for *E. coli* along with bacteria sampling results and reduction goals for Iron Brook (CT1000-00_trib_01) are provided in Table 21. Only one station (17621) was analyzed on the segment and it resulted in a geometric mean of 161 cols/100mls that exceeds the WQS for *E. coli*. There was one result that exceeded the single sample WQS with a result of 2600 cols/100mls. Further analysis involved a wet weather and dry weather geometric mean calculation. The wet weather calculation resulted in an exceedance while the dry weather geometric mean was not above WQS.

Segment 7 (CT-E1_001-SB): In table 16, the data is compared with water quality criteria for recreation, enterococci. The segment has one exceedance for each of the single sample and geometric mean criteria in 2010, 2011, and 2012. When all data is analyzed utilizing precipitation data, the northern station shows a geometric mean exceedance and both stations show wet weather exceedances of geometric mean criteria. Neither station showed a dry geometric mean exceedance during the sampling period. As shown in Table 22, the 90th percent of samples value exceeded the WQS for fecal coliform multiple times during the sampling period at several stations in Segment 7. The geometric means for each station and year exceeded WQS during a vast majority of the datasets in the segment. Geometric means were also calculated for each station during wet-weather and dry-weather conditions, and most stations exceeded the WQS for fecal coliform under both conditions except for station 12-17 which did not exceed the WQS for dry weather geometric mean.

Segment 8 (CT-E1_002-SB): As shown in Table 23, the 90^{th} percent of samples value exceeded the WQS for fecal coliform multiple times during the sampling period at several stations in Segment 8. The geometric means for each station and year exceeded WQS during most of the datasets in the segment. Geometric means were also calculated for each station during wet-weather and dry-weather conditions, and most stations only exceeded the WQS for fecal coliform during wet weather conditions. The exception was station 12-8 which exhibited no exceedances of the WQS in wet or dry conditions.

Segment 9 (CT-E2_001): As shown in Table 24, the geometric mean and 90^{th} percent of samples value exceeded the WQS for fecal coliform multiple times one of the two monitoring stations in Segment 9 during the sampling period. The geometric means for one station (137-18.1) exceeded WQS. Geometric means were also calculated for each station during wet-weather and dry-weather conditions, and no station exceeded the geometric mean WQS for fecal coliform in either condition.

Segment 10 (CT-E3_001): As shown in Table 25, the geometric mean and 90^{th} percent of samples value exceeded the WQS for fecal coliform multiple times at the only monitoring station in Segment 10 during the sampling period. The geometric mean exceeded WQS only during the 2006 sampling efforts. Geometric means were also calculated for each station during wet-weather and dry-weather conditions, and the station exceeded the WQS for fecal coliform under both conditions.

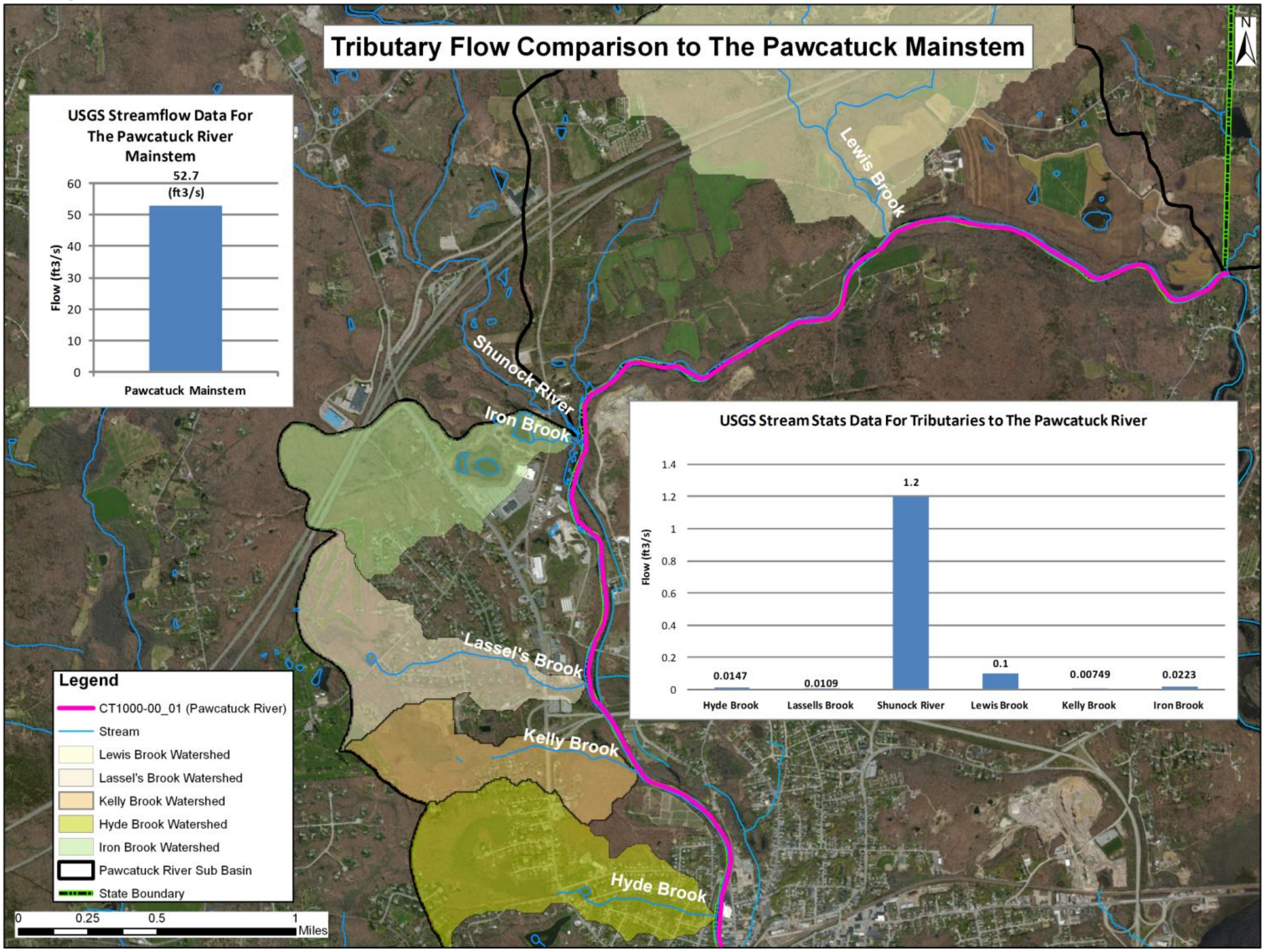
The RIDEM impairs four segments in the Pawcatuck River estuary due to fecal coliform bacteria concentrations. All monitored stations on these segments violate the geometric mean and 90^{th} percentile criteria for fecal coliform used by RIDEM in wet and dry weather conditions. There are significant impairments occurring during wet weather. The datasets show a decreasing trend in concentrations moving downstream from the freshwater Pawcatuck River into the estuary segments. This trend is accentuated during dry weather conditions.

TRIBUTARIES AND LOADING

To help characterize the contributions from the freshwater tributaries, CT DEEP evaluated flow rates and bacteria concentrations. All monitored tributaries have significantly lower flow volumes than the mainstem of the Pawcatuck River. The Q99 flows for each tributary were estimated using USGS Stream Stats software. These flow rates were compared the Pawcatuck mainstem and are highlighted in Figure 10 below. The tributary flow volumes were all orders of magnitude below the Pawcatuck River. Lewis Brook exhibited the largest flow rate of 0.1 cfs in comparison the Pawcatuck River exhibited 52.7cfs.

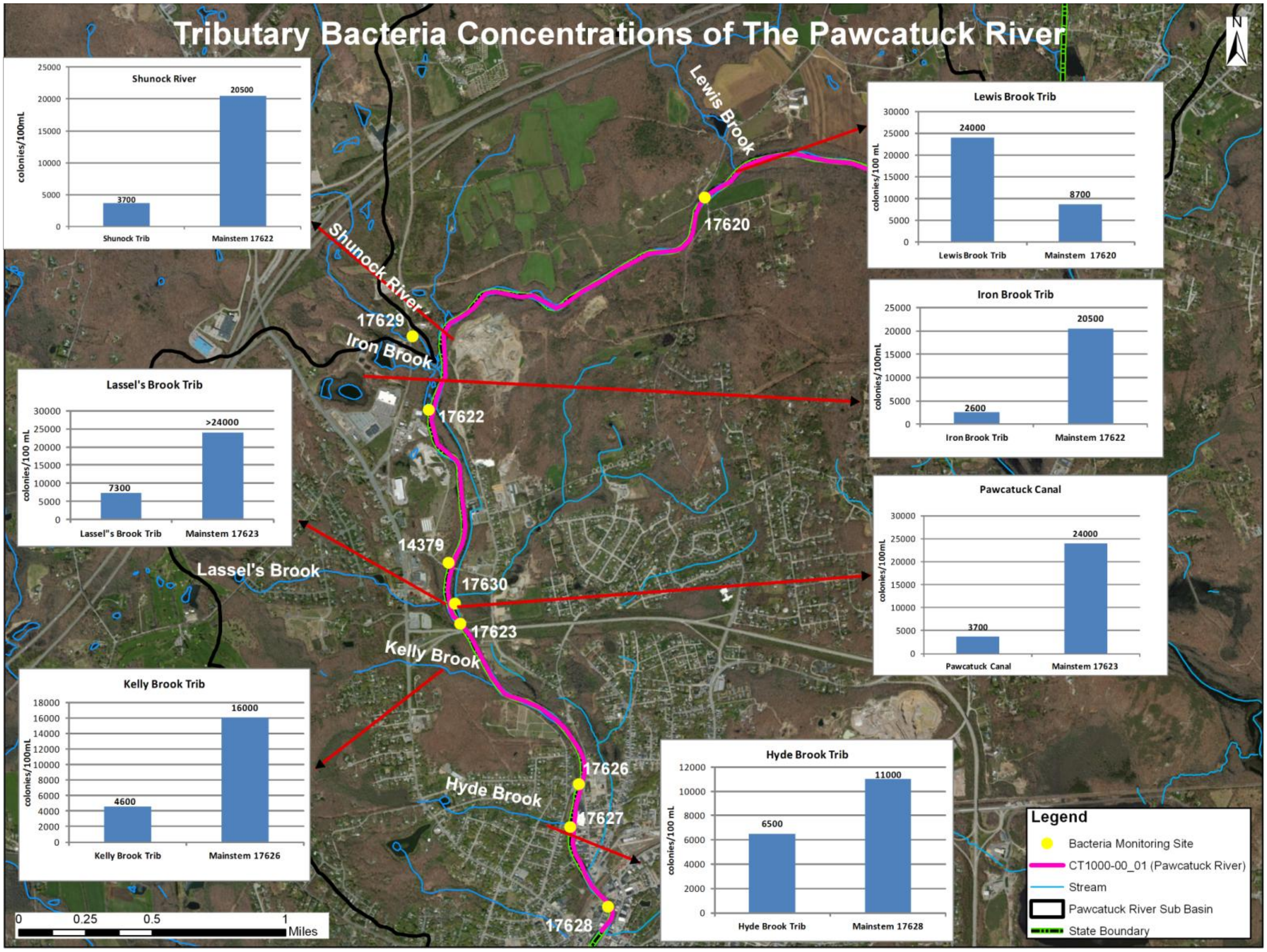
The Shunock River is also a major tributary of the Pawcatuck River. This waterbody was not included in the Pawcatuck TMDL, due to a previously approved TMDL for the Shunock that was completed in 2012, http://www.ct.gov/deep/lib/deep/water/tmdl/statewidebacteria/shunockriver1004.pdf. The estimated stream flow for the Shunock, using Stream Stats is 1.2 cfs. This volume is still significantly lower than the overall flow volumes of the Pawcatuck mainstem. However, it is also an order of magnitude larger than the other tributaries analyzed in this TMDL document.

Figure 10. Stream Flow Comparisons of Mainstem versus Tributaries



A comparison of the maximum bacteria concentrations at the mouth of each tributary and the most proximal mainstem stations is included in Figure 11. While every tributary exhibited concentrations larger than the recreation criteria, only one stream was actually a larger concentration than the mainstem. Lewis Brook recorded a count of 24,000 cols/100mls while the maximum on the mainstem of the Pawcatuck was only 8700 cols/100mls. The other tributaries exhibit a combination of very low flows and smaller concentrations of bacteria entering into the Pawcatuck mainstem. These tributaries may be a source of bacteria loading but are not likely to be the driving force of the water quality exceedances. Other inputs must be providing bacteria loads to result in the elevated mainstem concentrations. The Shunock River recorded a maximum value of 2900 cols/100mls during the sampling period (2006-2009) analyzed in the Shunock TMDL document. This concentration is only slightly larger than Iron Brook, a much smaller nearby tributary. The Shunock bacteria concentration is also much lower than the recorded values of the Pawcatuck mainstem near the confluence of the two rivers.

Figure 11. Maximum Bacteria Concentration Comparisons



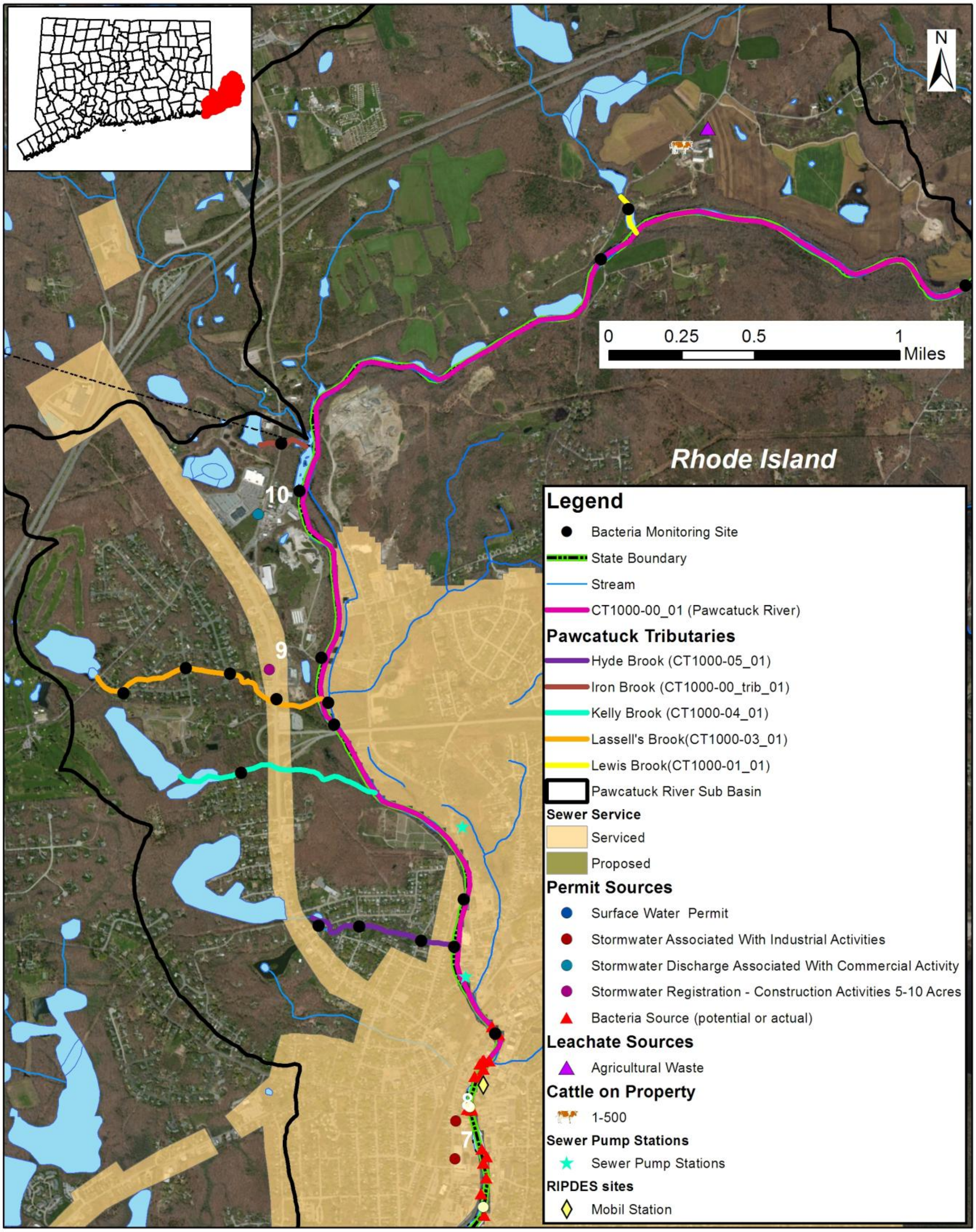
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), and illicit discharges to the waterbody. Potential sources that have been tentatively identified in the Pawcatuck River watershed based on land use (Figure 7) and through a review of local information provided by health departments, watershed groups and other organizations is presented in Table 4 below and shown in Figures 12 and 13. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segment. Further monitoring and investigation will confirm listed sources and discover additional sources. Some segments in this watershed are currently listed as unassessed for designated uses by CT DEEP. This means that there are no data that can be used to assess the water quality and attainment of the designated use. In some of these segments there are data from permitted sources and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 4: Potential bacteria sources in the Pawcatuck River and Estuary

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Pawcatuck River CT1000-00_01	x	x		x	x	x	x	x
Lewis Brook CT1000-01_01	x	x		x	x	x	x	x
Lassell's Brook CT1000-03_01	x	x		x		x	x	x
Kelly Book CT1000-04_01	x	x		x		x	x	x
Hyde Brook CT1000-05_01	x	x		x		x	x	x
Iron Brook CT1000-00_trib_01	x	x		x	x	x	x	x
LIS EB Inner - Pawcatuck River, CT-E1_001-SB	x	x		x		x	x	x
LIS EB Inner – Pawcatuck River, CT-E1_002-SB	x			x		x	x	x
LIS EB Shore-Wequetequock Cove, CT-E2_001	x			x	x	x	x	
LIS EB Midshore, CT-E3_001	x	x		x		x	x	x

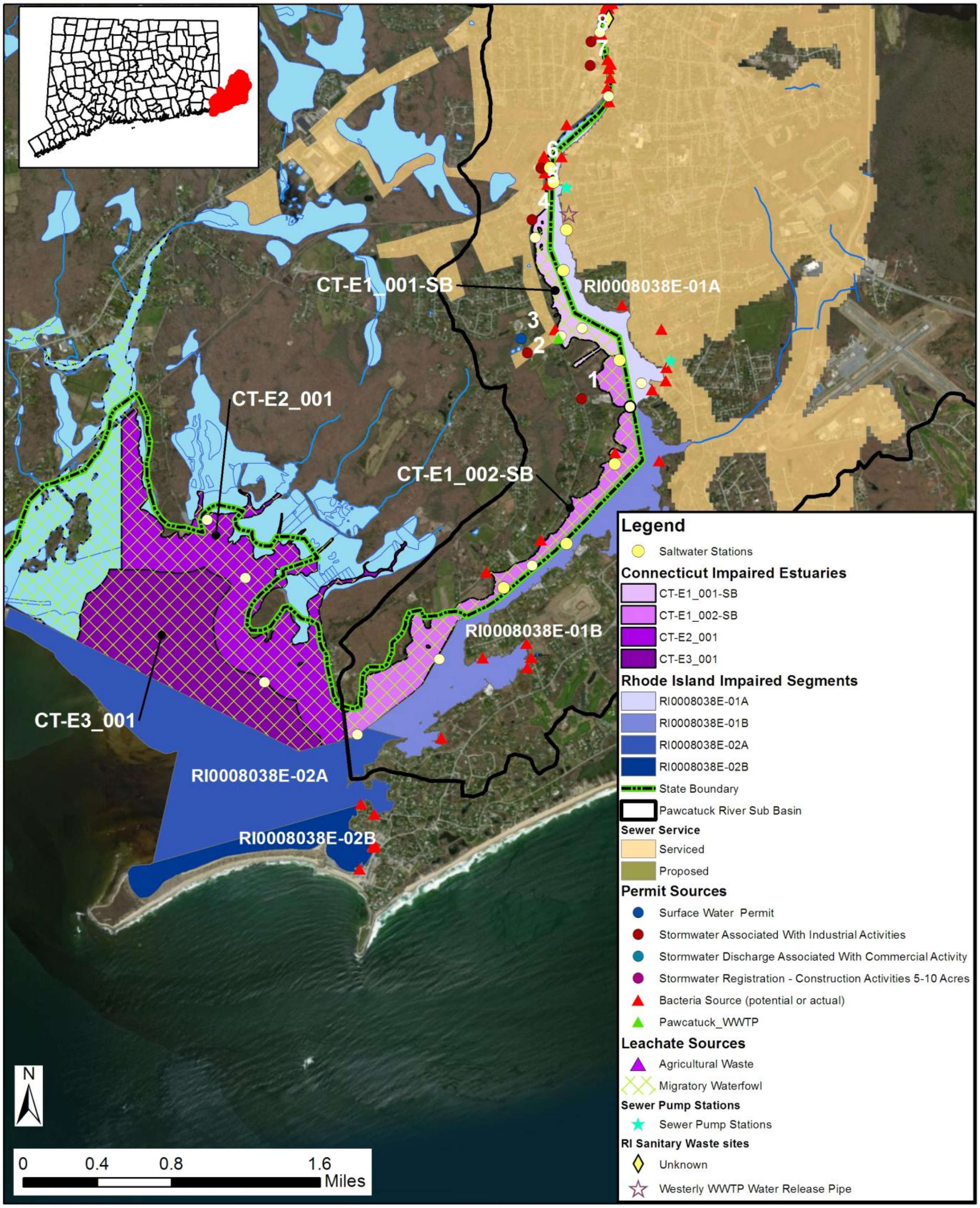
Figure 12: Potential freshwater bacteria sources in the Pawcatuck River and tributaries



Potential Bacteria Sources Freshwater Pawcatuck River

Map Data: DEEP Map Created: October 2013

Figure 13. Potential saltwater bacteria sources in the Pawcatuck Estuary



Potential Bacteria Sources Pawcatuck Estuary

Map Data: DEEP Map Created: June 2013

The potential sources maps for the impaired basin were developed after thorough analysis of available data sets. If information is not displayed in the map it is because no examples of that specific source were discovered to be present during the analysis of the basin. The following is the list of potential sources that were evaluated during analysis of the impaired basin: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

In the Pawcatuck watershed, permitted sources exist that could potentially contribute to the bacteria loading in the affected segments. These permitted discharges are identified in Table 5. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Table 7.

Table 5: General categories list of other permitted discharges in Connecticut

Permit Code	Permit Description Type	Number in Connecticut section of watershed
CT	Surface Water Discharges	1
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	1
GSI	Stormwater Associated with Industrial Activity	7
GSM	Part B Municipal Stormwater MS4	1
GSN	Stormwater Registration – Construction	1
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Other Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Pawcatuck River watershed. Bacteria data from 2001-2003 from several of these industrial permitted facilities are shown in Table 7 (where available). This data cannot be compared to the recreational water quality standard as Connecticut does not have a water quality standard to evaluate recreational use for fecal coliform bacteria. While none of the results presented in Table 7 would be considered elevated or exceedances, these discharges, and other discharges in the watershed without any sample results, could still be a potential source of bacterial contamination to the Pawcatuck River. All NPDES permitted facilities will need to monitor for the appropriate indicator bacteria and utilize the more conservative water quality criteria, whether it is from Connecticut or Rhode Island Water Quality Regulations.

Also displayed in Table 6 is the Surface Water Discharge Permit (CT0101290) for the Stonington-Pawcatuck Publicly Owned Treatment Works (POTW) in Stonington. The discharge from this POTW enters the Pawcatuck River. As shown in Figures 12 and 13, the discharge from this POTW is downstream of the Connecticut freshwater impaired segment and therefore not contributing bacterial contamination to the impaired freshwater mainstem segment. However, the discharge is located on an impaired estuary section. Results from the POTW are included and displayed in Table 9 of this document and the plant has not experienced any violations of its permit standards during evaluated data collections.

Table 6: Permitted facilities within the Pawcatuck River watershed

Town	Client	Permit ID	Permit Type	Site Name	Address	Sources Map ID #
Pawcatuck	Kayla Group LLC Northeast Marine Liquidation, Inc.	GSI002235	Stormwater Associated With Industrial Activities	Northeast Marine Liquidation Inc.	50 Mechanic St	8
Pawcatuck	Stonington On The River, Inc.	GSI002288	Stormwater Associated With Industrial Activities	Stonington On The River Dockominiums	257 River Rd	1
Pawcatuck	Town Of Stonington	GSI001756	Stormwater Associated With Industrial Activities	Pawcatuck POTW	38 Mary Hall Rd	2
Pawcatuck	Norwest Marine, Inc.	GSI001078	Stormwater Associated With Industrial Activities	Norwest Marine, Inc.	7 River Rd	4
Pawcatuck	John Hickey	GSI000715	Stormwater Associated With Industrial Activities	Connors & O'Brien Marina	197 Mechanic St	5
Pawcatuck	AGS Marine LLC	GSI002418	Stormwater Associated With Industrial Activities	Connors & O'Brien Marina	197 Mechanic St	6
Pawcatuck	Yardney Technical Products Inc.	GSI000342	Stormwater Associated With Industrial Activities	Yardney Technical Products, Inc.	82 Mechanic St	7
Stonington	Town of Stonington	GSM000056	Part B Municipal Stormwater MS4	Stonington, Town of	Entire town	N/A
Stonington	Readco	GSC000151	Stormwater Discharge Associated With Commercial Activity	Hoyts Cinemas Corporation	85 Voluntown Road	10
Stonington	Windham Crossing LLC	GSN002113	Stormwater Registration - Construction Activities 5-10 Acres	Tractor Supply Company-Stonington	335 Liberty Street	9
Stonington	Town Of Stonington	CT0101290	Surface Water Permit	Stonington Pawcatuck POTW	38 Mary Hill Road	3

Table 7: Industrial permits in the Pawcatuck River watershed and available fecal coliform data (colonies/100mL). (Not all permits in table 6 have available data)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Stonington	Norwest Marine	GSI1078	Pawcatuck River	drain site	09/20/01	15
Stonington	Norwest Marine	GSI1078	Pawcatuck River		09/23/02	0
Stonington	Norwest Marine	GSI1078	Pawcatuck River	drain site	9/18/12	165
Stonington	Yardney Technical Pdts	GSI342	Pawcatuck River	DSN6014	09/25/01	7
Stonington	Yardney Technical Pdts	GSI342	Pawcatuck River	DSN6014	10/11/02	6
Stonington	Stonington on the River	GSI2288	Pawcatuck River	#1	10/19/12	84
Stonington	Pawcatuck WPCF	GSI1756	Pawcatuck River	#1	9/28/12	5
Stonington	Pawcatuck WPCF	GSI1756	Pawcatuck River	#1	8/13/ 13	30
Stonington	Connor's & O'Brien Marina	GSI2418	Pawcatuck River	Outfall 1	9/28/12	5

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer system (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate state agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place (67 FR 11663).

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA (67 FR 11663).

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an

MS4 permit. This oversight can explain why a municipality that is at least partially shaded grey in the maps has no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program One reason a waiver could be granted is a municipality with a total population less than 1000 people living in the UA portion of the municipality. The 19 municipalities in Connecticut that have received waivers are: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segments of the Pawcatuck River watershed are located within the Towns of Stonington, and North Stonington and the city of Westerly, Rhode Island. Stonington has designated urban areas, as defined by the U.S. Census Bureau, and is required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figures 14 and 15). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit required municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website www.ct.gov/deep/stormwater.

Table 8 (below) displays sample results for *E. coli* testing of MS4 discharges within the Pawcatuck River watershed (where available) collected by employees from the Town of Stonington. Stonington had three different outfalls sampled with a total of twenty samples. Nine out of the 20 (45%) samples from Stonington exceeded the single sample WQS for *E. coli*. These results indicate that Stonington's MS4 discharges are a likely source of bacterial contamination to the Pawcatuck River. Rainfall information was not readily available for inclusion in this document. The MS4 type is a general descriptor for the landuse in the area surrounding the discharge location.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

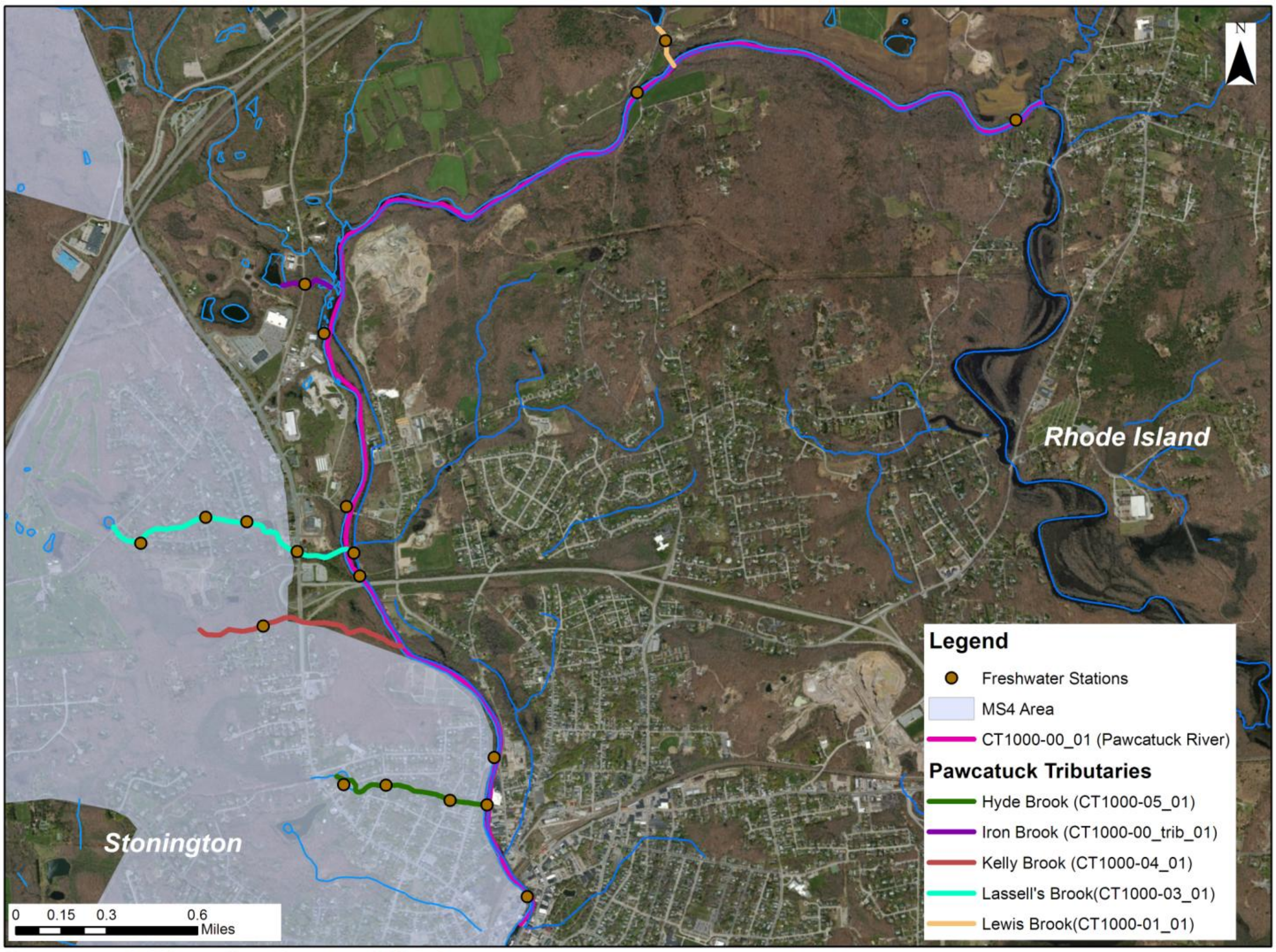
In addition to the locations sampled and reported on below the RIDEM TMDL document recommends some additional sampling at the Broad Street Bridge and a separate outfall at Riverside Drive. Limited sampling by RIDEM at these locations resulted in some elevated fecal coliform concentrations. It is not stated in submitted reports from Stonington, whether municipal staff took any actions to collect data at these proposed additional locations. The RIDEM document also recommends that Stonington investigate lowering bacteria concentrations in its municipal stormwater using available practices and techniques including good housekeeping and LID practices.

Table 8: MS4 permit and locations in the Pawcatuck River watershed with *E. coli* Sample results

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	12/07/04	650
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	09/15/05	10
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	10/17/06	240
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	10/10/07	120
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	09/26/08	530
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	10/28/09	20
Stonington	C1-CB on E side of RD just S of CC O'Brien’s @ 8 Mechanic ST in Pawcatuck	Commercial	Pawcatuck River	10/15/10	160
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	12/07/04	105
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	09/15/05	240
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	10/17/06	1,120
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	10/10/07	150
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	09/26/08	2,100
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	10/28/09	20
Stonington	I1-outfall on E side of rd @ intersection of Clark & Mechanic St in Pawcatuck	Industrial	Pawcatuck River	10/15/10	>24,200
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	12/07/04	5,050
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	09/15/05	>1000
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	10/17/06	40

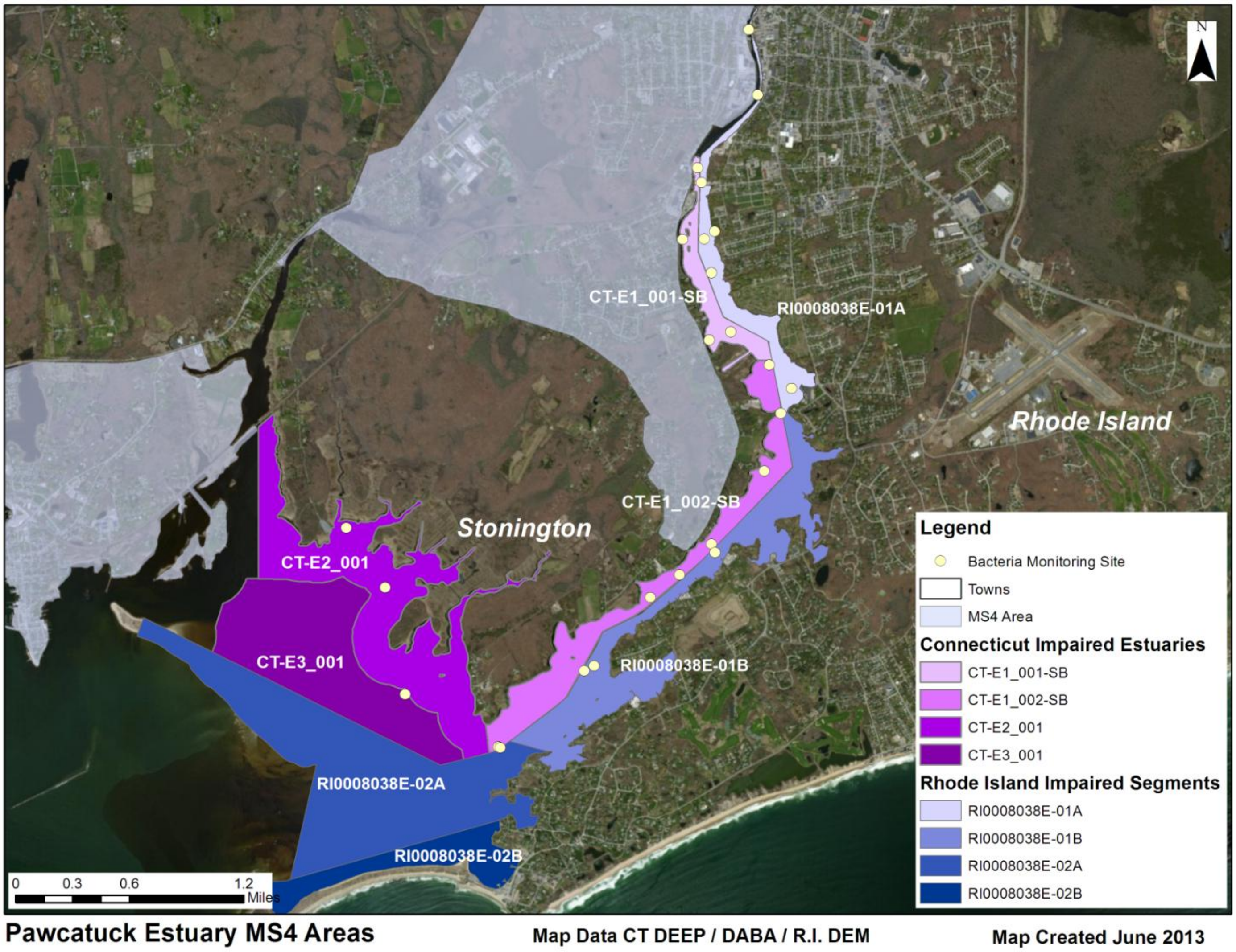
Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	09/26/08	5,170
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	10/28/09	400
Stonington	R-1 outfall @ NE end of Walnut St in Pawcatuck	Residential	Pawcatuck River	10/15/10	>24,200
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Figure 14: Connecticut MS4 areas of the Pawcatuck River Freshwater Section



Pawcatuck River Freshwater MS4 Areas Map Data CT DEEP / R.I. DEM Map Created October 2013

Figure 15. Connecticut MS4 areas of the Pawcatuck Saltwater Estuary



Publicly Owned Treatment Works

The Stonington-Pawcatuck POTW (CT0101290) is located on the Pawcatuck River on South Smith Street and has the potential to impact the shellfish growing waters in the Pawcatuck Estuary (Pawcatuck, 2009). According to the 2011 Annual Assessment of the Shellfish Growing Waters in the Town of Stonington (DABA 2011) there were no violations at the POTW during 2011. CT DEEP permitting data agrees with this conclusion. Bacteria data from the effluent of the Pawcatuck Water Pollution Control Facility are included in Table 9. The plant did not exceed its permit limits on any date sampled.

Table 9: Water treatment plant fecal coliform (colonies/100 mL) data discharging to the Pawcatuck Estuary

Town	Permittee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	01/31/2009	4	16
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	02/28/2009	1	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	03/31/2009	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	04/30/2009	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	05/31/2009	2	3
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	06/30/2009	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	07/31/2009	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	08/31/2009	2	5
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	09/30/2009	3	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	10/31/2009	3	7
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	11/30/2009	3	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	12/31/2009	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	01/31/2010	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	02/28/2010	2	9
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	03/31/2010	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	04/30/2010	2	5
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	05/31/2010	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	06/30/2010	4	30
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	07/31/2010	3	6
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	08/31/2010	2	3
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	09/30/2010	3	5
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	10/31/2010	3	15
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	11/30/2010	2	5
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	12/31/2010	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	01/31/2011	1	2
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	02/28/2011	2	3
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	03/31/2011	2	4

Town	Permittee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	04/30/2011	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	05/31/2011	2	8
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	06/30/2011	2	4
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	07/31/2011	2	8
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	08/31/2011	4	8
Pawcatuck	Pawcatuck WPCF	CT0101290	Pawcatuck Estuary	09/30/2011	7	16
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL **7-Day Geometric Mean Permit Limit = 400 colonies/100 mL**						

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with landuse practices. Examples of NPS that can contribute bacteria to surface waters include, but are not limited to: malfunctioning septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). With the waters of the Pawcatuck Estuary being tidally influenced, many bacterial sources that appear to be downstream of the impaired segment may be affecting the water quality in upstream segments. Potential sources of NPS within the Pawcatuck River watershed and estuary are displayed in Figures 12 and 13.

Stormwater Runoff from Developed Areas

A large portion of the Pawcatuck River watershed is considered urban. Approximately 17% of the land use is classified as urban, and much of that area is concentrated around the impaired freshwater segment, in Stonington and North Stonington in Connecticut, and on the other side of the river in Westerly, RI. (Figure 5). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. During 2008 the Town of Stonington published a Phase 2 Stormwater Report, there were 64 stormwater outfalls located and mapped in the Pawcatuck survey area. Most of these outfalls were located in Prohibited and restricted areas of the estuary. Each outfall can be considered as a potential bacteria source. Past studies have shown a link between the amount of impervious area in a watershed and water quality conditions (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

The watershed is characterized by four impervious cover percentage ranges. The majority of the watershed (41%) is characterized by land with 0 to 6% impervious cover, while 28% of the land has 7 to 11% impervious cover, and 30% of the land is covered by 12 to 15% impervious. Less than 1% of the watershed is characterized by >16% impervious cover (Figure 16). Given the amount of impervious surfaces in the watershed and the proximity of those surfaces to the impaired segments, stormwater is a potential source of bacterial contamination to the Pawcatuck River and its tributaries and estuary.

Figure 16: Range of impervious cover (%) in the Pawcatuck River watershed (CT)

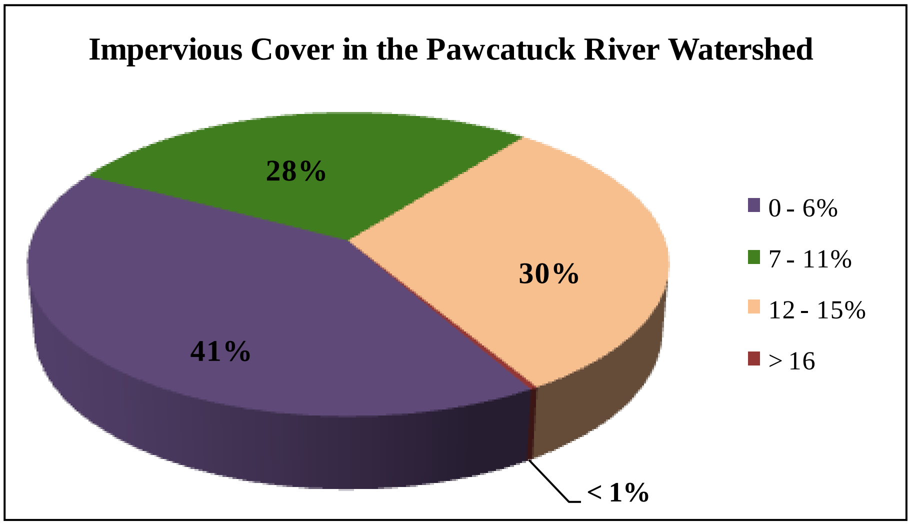
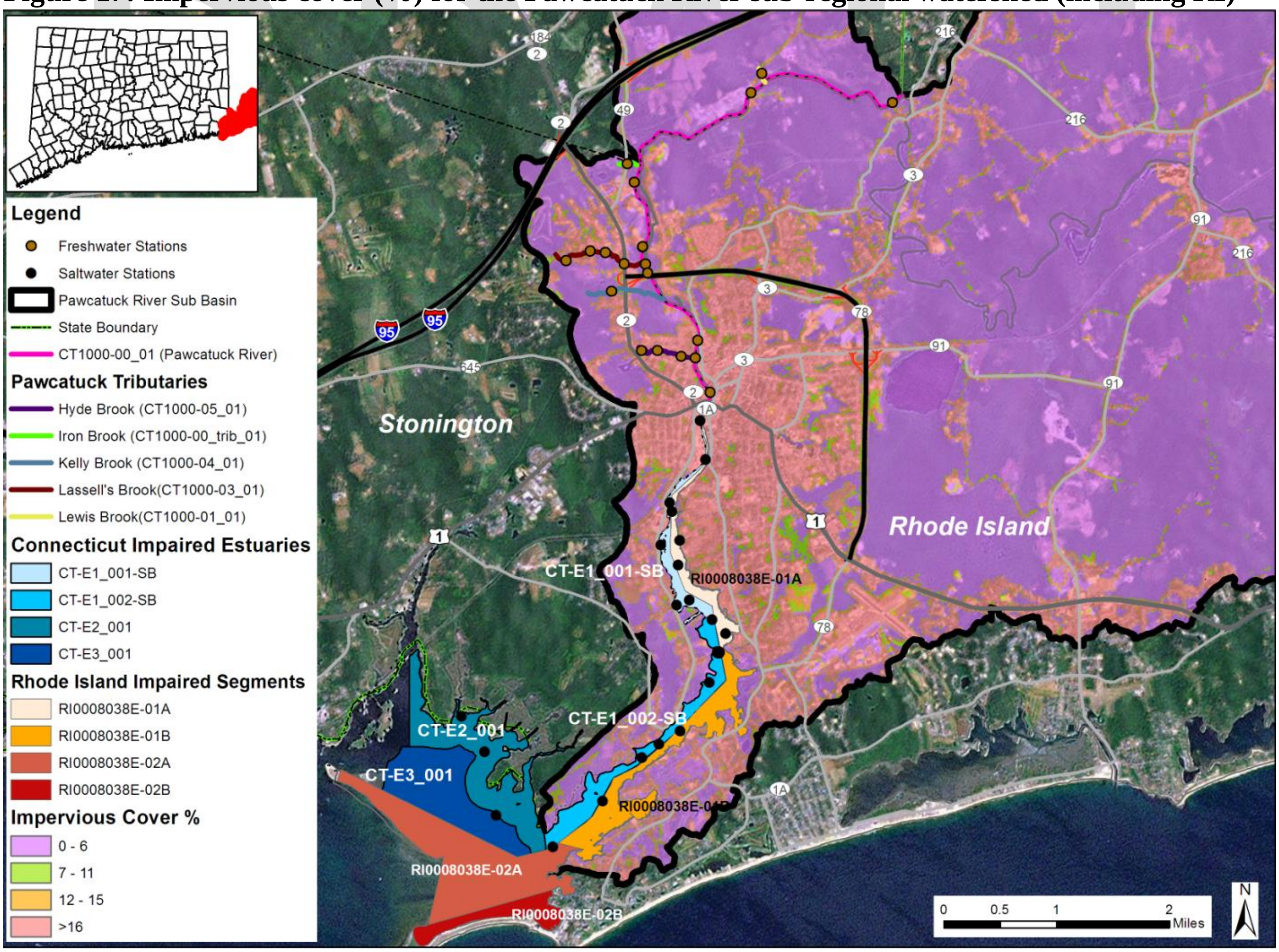


Figure 17: Impervious cover (%) for the Pawcatuck River sub-regional watershed (including RI)



Impervious Surfaces In The Pawcatuck River Sub Regional Basin Map Data: DEEP Map Created: October 2013

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of Connecticut. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, landing application of manure, livestock holding and feeding areas, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of a vegetated buffer along the shoreline. Agricultural land use makes up 6% of the Pawcatuck River watershed. There are several areas where agricultural lands are adjacent to the impaired segment of the Pawcatuck River and its tributaries.

Figure 18. Cattle in Pawcatuck River at Boom Bridge Road Station 17620

There is a very large agricultural area off Anthony Road and Boom Bridge Road in North Stonington. As shown in Figure 12, this area is adjacent to the Pawcatuck River and has between 1-500 head of cattle as delineated in ARCGIS. This area has also been identified in Figure 12 as a potential source of bacterial contamination from agricultural wastewaters and contaminated stormwater runoff. Figure 18 shows evidence that agriculture is likely creating some inputs of bacteria loading to the river.

Based on the landuse maps, there are also large agricultural areas adjacent to the Pawcatuck River and a tributary of the river, off of Ella Wheeler Road and Pendleton Hill Road in North Stonington. Agricultural areas near the impaired segment and its tributaries are potentially carrying pollutants, including bacteria, into the Pawcatuck River.

An additional farm is located on the lower Pawcatuck River that previously had seven beef cows on the property. The farm has since converted to raising chickens which changes which BMPs are most valuable to implement at the farm to help mitigate bacteria and waste from entering the Pawcatuck River.

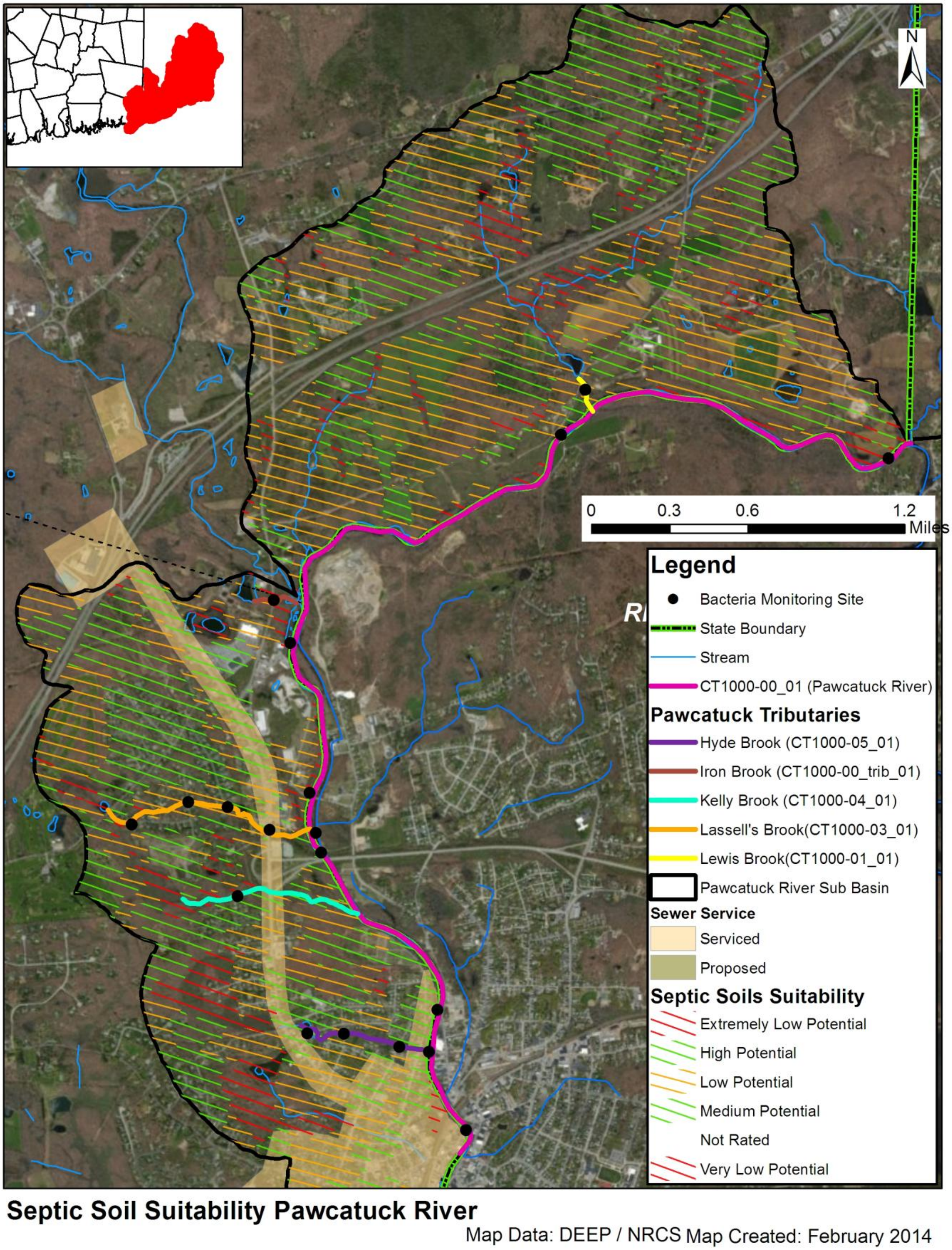
Malfunctioning Septic Systems and Illicit Discharges

As shown in Figures 12 and 13, a portion of the watershed within Connecticut has access to the sanitary sewer system. However, large portions of the watershed in Stonington and North Stonington do not have access to a sanitary sewer. Households and businesses in these portions of the watershed must rely on onsite wastewater treatment systems, such as septic systems, to dispose of their sanitary waste. There may be undetected failed septic systems in these portions of the watershed. Malfunctioning or failing septic systems can be significant sources of bacteria if raw waste is allowed to reach surface waters.

In the 2008 Sanitary Survey from DABA (2012 (a)), 514 parcels were identified in the shoreline survey database. Seven properties were referred back to the Town for follow-up investigation due to failures or suspicion of failure. All of these parcels and systems were further investigated and many have been remediated at the writing of the Sanitary Survey document. Future surveys may turn up similar situations for the Town and land owners to work on remediating.

Figure 19 shows areas of Stonington and North Stonington that have relatively suitable soils for installation of a single family residential subsurface disposal system. The map data is based on NRCS soil survey information and has been included for use as a planning device in the document. The assumptions for the data layer are a single family 4 bedroom home on a 1 acre lot with a private well or a ½ acre lot with public water supply. A typical system used in the determination for the GIS layer is a 1250 gallon septic tank and a 660 to 100 square foot leaching field. These are the assumptions used to determine soil suitability and are not meant to reference what a typical house should be utilizing for its subsurface disposal system. The data is accurate to a minimum delineation of 3 acres and was last updated in 2007.

Figure 19. Soil Suitability for Septic Systems in the Pawcatuck Watershed



In Connecticut, local health directors or health districts respond to complaints about any malfunctioning or failing septic systems in their specific municipalities. The Town of North Stonington has its own health department (http://www.northstoningtonct.gov/Pages/NStoningtonCT_Dept/Health/index), and the Town of Stonington has its own Sanitarian http://www.stonington-ct.gov/Pages/StoningtonCT_Sanitarian/index) who are responsible for regulating the proper installation and operation of septic systems in each municipality.

Nearly all of the area surrounding the Pawcatuck River's impaired freshwater segment in downtown Stonington is serviced by municipal sanitary sewer. Sewer system leaks and other illicit discharges that are located within the watershed of the impaired segment of the Pawcatuck River could be contributing bacteria to the waterbody. Much of the freshwater segment and analyzed tributaries are not located near areas with sewer service.

Personal care products and pharmaceuticals (PCPP) can be utilized as indicators of human discharges to a waterbody. During the summer of 2011, CT DEEP conducted additional sampling for PCPP on the Pawcatuck River mainstem. These efforts resulted in limited datasets with positive results for cholesterol and caffeine at some of the stations. Other sample results were for trace or presence of Bisphenol-A and DEET. While it is difficult to make conclusions based on the small dataset, further investigation into these areas and additional monitoring may lead to the discovery of illicit discharges and connections to the Pawcatuck River which could be sources of bacterial and other contamination depending on the type of connection. The table of results is included in Appendix 4.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Pawcatuck River watershed represent another potential source of bacteria. Wildlife, including waterfowl, may be a significant bacteria source to surface waters. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of these natural sources on water quality (USEPA, 2001).

Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, agricultural crop fields, and ponds. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and ponds and cause water quality problems due to bacterial contamination associated with their droppings. A portion of the Elm Ridge Golf Course is within the Pawcatuck River watershed on Elm Ridge Road in Stonington. The golf course drains into Lassell's Brook, one of the listed freshwater tributaries in this document. The Pawcatuck River watershed is also comprised of 4% surface water. Figure 13 includes graphic representation of areas on the Pawcatuck River and estuaries that have been identified as migratory wading waterfowl habitat by CT DEEP wildlife staff. This indicates that waterfowl such as geese are likely entering the Pawcatuck River in large numbers. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. These factors make wildlife waste a potential source of bacteria to the Pawcatuck River.

According to the US Fish and Wildlife Service (FWS), the Pawcatuck River is one of six major swan-gathering spots in Rhode Island. RIDEM has not conducted reduction activities in the Pawcatuck for many reasons including the fact that the river is a shared state boundary. In the RIDEM Pawcatuck TMDL, there is mention that the waterfowl tend to congregate on the Connecticut side of the river and Connecticut does not have any control program (Osenkowski, 2009). Future partnership efforts between the two states and US FWS may help to reduce the impacts caused by nuisance waterfowl along the Pawcatuck River.

Also, urban development surrounds most of the impaired segment of the Pawcatuck River (Figure 6). Residential development is also very dense in the downstream portions of the river's impaired segment in Stonington. Waste from domestic animals such as dogs, when not disposed of properly, can enter surface waters directly or through stormwater infrastructure. Feral cats that have been drawn to informal feeding areas, can also be a source of bacteria loading in dense residential areas. Therefore, domestic animal waste may also be contributing to bacteria concentrations in the Pawcatuck River.

Marinas

As noted previously, multiple marinas are located within the Pawcatuck Estuary (Figure 12 and 13 and Table 6). Marinas are located at the water's edge, and if no measures are taken to reduce pollutants, including buffering, pollutants can be transported via runoff from parking lots and hull maintenance areas directly into the marina basin. Common pollutants from marinas include bacteria and nutrients from stormwater runoff, solid and liquid materials used in boat maintenance and cleaning, fuel and oil, sewage from public restrooms and boat pump-outs, fish waste, and turbidity from boating activities.

The use of pump out boats and facilities dramatically reduce bacteria loading from boats. The CT DEEP has information on regional pump-out boats and facilities at its website, Connecticut Statewide Pumpout Facilities List. There is a boat operating specifically in the Pawcatuck region, the Dodson Pumpout Boat. The service is free and reduces the possibility of vessels dumping raw wastes into Long Island Sound, which is prohibited by CT Water Quality Standards number 24, "the discharge of sewage from any vessel to any water is prohibited."

There are two mobile pump-out facilities that are an example of collaboration between CTDEEP and RIDEM. These were purchased by the Town of Westerly, RI and are operated with funds from CT DEEP. The pump-out boats service boats on both sides of the river reducing the potential risk of waste discharges directly into the Pawcatuck River.

During collaborative efforts between RIDEM and CTDEEP in 2006, a houseboat was identified as a potential bacteria source. CT Bureau of Aquaculture has investigated and reports that the boat has no bathroom on board and that the occupants use onshore facilities (personal communication 2010).

Recreation

People coming in direct contact with surface water presents another potential source of bacterial contamination. Microbial source tracking (MST) surveys conducted in New Hampshire have shown humans to be a source of bacterial contamination at beaches (Jones, 2006). Since there are several swimming areas along the shoreline, it is probable that some bacterial contamination can be attributed to human activities in the Pawcatuck Estuary.

Additional Sources

There may be other sources not listed here or identified in Figures 12 or 13 which contribute to the observed water quality impairments in the Pawcatuck River watershed and estuary. Further monitoring and investigation will confirm the listed sources and potentially discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

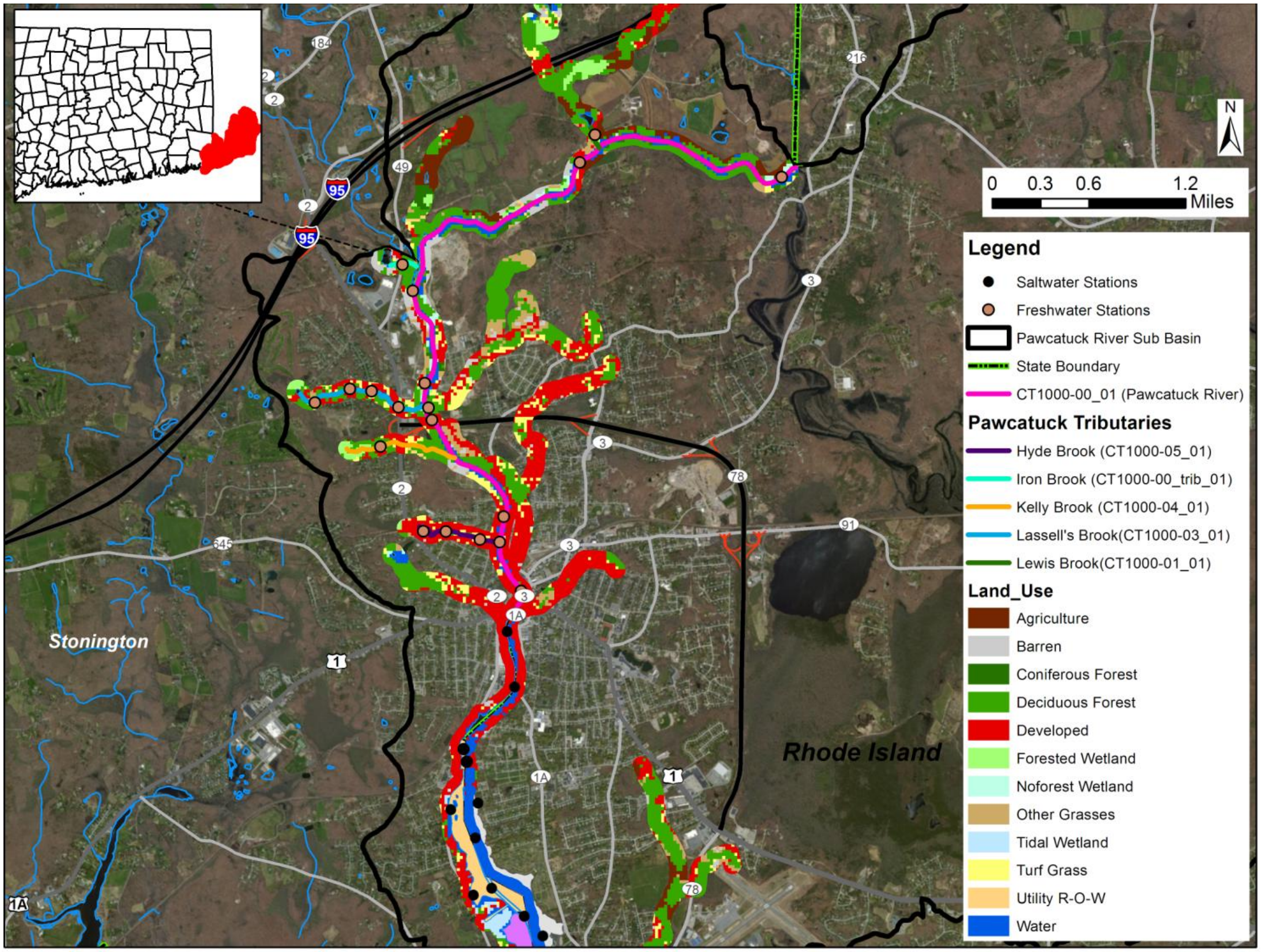
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their unique soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has mapped streamside buffer information for the entire State of Connecticut (http://clear.uconn.edu/) and this data have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The majority of the riparian zone for the impaired segment of the Pawcatuck River is characterized by developed land uses (Figure 20). Sections of the riparian zone are also characterized by agricultural, forested, and turf grass land uses. As previously mentioned, developed and agricultural areas are potential sources of bacterial contamination.

Figure 20: Riparian buffer zone information for the Pawcatuck River watershed



Riparian Buffers Pawcatuck River Map Data: DEEP / UCONN CLEAR Map Created: October 2013

CURRENT MANAGEMENT ACTIVITIES

In 1993 the Pawcatuck River Estuary and Little Narragansett Bay Interstate Management Plan was developed by the Rhode Island Coastal Resources Management Council and the Connecticut Department of Environmental Protection. The management plan was finalized in 1993 and is available for viewing at: http://www.ct.gov/deep/lib/deep/water/watershed_management/wm_plans/pawcatuck.pdf. While the plan focuses on the saltwater estuary and tidal portions of the Pawcatuck River watershed, it does identify the freshwater portion of the Pawcatuck River as the major source of pollutants entering the downstream estuary reaches. There are several recommendations made within the plan to address pollutant loads, including bacterial contamination, to the freshwater portions of the Pawcatuck River in Connecticut and Rhode Island.

The 2010 RIDEM TMDL for the Pawcatuck River and Little Narragansett Bay covers estuarine sections, gives recommendations for reductions and provides data from sources across the watershed. There is also discussion regarding the freshwater portion of the river. All RIDEM stations in the Pawcatuck River estuary violate the geometric mean and/or 90th percentile criteria during both dry and wet weather with significant impairments occurring in wet weather. The freshwater Pawcatuck River is a bacteria source to the estuarine Pawcatuck River, especially in wet weather, but there also exist many significant dry and wet weather bacteria sources that discharge directly to estuarine Pawcatuck River. As expected by the increased flushing and its distance from actual and potential bacteria sources, water quality improves in Little Narragansett Bay.

In addition, the National Shellfish Sanitation Program (NSSP) has multiple requirements for the protection and evaluation of shellfish growing areas. More information about this program is provided below and available online:
http://www.fda.gov/Food/GuidanceRegulation/FederalStateFoodPrograms/ucm2006754.htm.

The NSSP requires the completion of a sanitary survey to determine acceptable and unacceptable growing areas, and to accurately classify a growing area as Approved, Conditionally Approved, Restricted, Conditionally Restricted, or Prohibited. A sanitary survey is an in-depth evaluation of all environmental factors impacting water quality in a shellfish growing area. Environmental factors include both actual and potential pollutant sources, whether natural or man-made, along with meteorological and hydrographic characteristics of the growing area. The principal components of a sanitary survey are: (1) identification and evaluation of pollutant sources, (2) evaluation of meteorological factors, (3) evaluation of hydrographic factors affecting the distribution of pollutants, and (4) assessment of water quality.

The sanitary survey includes data and results from the following:

1. Shoreline survey;
2. Survey of the bacteriological quality of the water;
3. Evaluation of meteorological, hydrodynamic, and geographic characteristics of the growing area;
4. Analysis of shoreline survey, bacteriological water quality, and meteorological, hydrodynamic, and geographic characteristics; and
5. Determination of the appropriate growing area classification.

Maintaining updated sanitary survey records consists primarily of routinely evaluating major pollutant sources, collecting water quality data from sampling stations under the selected NSSP water quality monitoring strategy, and analyzing the data to ensure that the classification continues to represent current sanitary conditions in the growing area. The entire sanitary survey process must be repeated every 12 years. In the interim, the sanitary quality of each growing area must be reviewed as often as necessary to ensure appropriate classification. Certain sanitary survey components are required by the Model Ordinance to be updated annually and triennially.

The growing area classification and supporting data from the sanitary survey shall be reviewed at least every three years. As required by the NSSP, this triennial re-evaluation shall include:

1. A review of water quality sampling results;
2. Documentation of any new pollutant sources and evaluation of their impact on the growing area;
3. Re-evaluation of all pollutant sources, including sources previously identified in the sanitary survey, as necessary to fully evaluate any changes in the sanitary conditions of the growing area. Re-evaluation may or may not include a site visit;
4. A comprehensive report analyzing the sanitary survey data and determining whether the existing growing area classification is accurate or requires revision; and
5. Reclassification of the growing area if re-evaluation determines that conditions for classification have changed based on data collected during the triennial review.

NSSP also requires that the sanitary survey be updated annually to reflect changes in conditions in the growing area. The annual re-evaluation shall include:

1. Field observation of pollutant sources during drive-through surveys, sample collections, or other information sources;
2. Addition and review of current year's water quality sampling results to a database collected in accordance with the bacteriological standards and sample collection required;
3. Review of available inspection reports and effluent samples collected from pollutant sources;
4. Review of available performance standards for various types of discharges impacting the growing area; and
5. A brief report documenting annual re-evaluation findings.

The most recent triennial re-evaluation for the Shellfish Growing Waters in the Town of Stonington was published in 2004 (DABA 2004). According to this report, no growing areas are candidates for re-classification.

Also, the Town of Stonington has developed and implemented some programs to protect water quality from bacterial contamination; these programs can be found detailed in table 10. As indicated previously, the Town of Stonington is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the state. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Table 10.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Stonington, CT (GSM000056)

Minimum Measure	Stonington 2012 Annual Report Update
Public Outreach and Education	1) In 2012, the Town partnered with "Save the Bay" and students from Mystic Middle School to install 40 storm drain markers on catch basins in Cove Road and Kidds Way. There are approximately 160 catch basins in town remaining to be marked.
	2) Task Force members use an Enviroscape model to teach about stormwater issues at Deans Mill Elementary School.
	3) Continue placing information on the Town website and working with a local group (CUSH) that provides even more stormwater information (www.cushinc.org)
Public Involvement and Participation	1) Continue installing catch basin markers with volunteer help in the summer of 2013.
	2) In 2008, the Town worked with a local environmental group, Clean Up Stonington Harbors, on the distribution of a stormwater brochure. The brochure was delivered to 11,825 homes via the Mystic River Press, to 4,305 homes via the Westerly/Pawcatuck Press, and to 7,600 homes via the Stonington Times.
Illicit Discharge Detection and Elimination	1) Completed outfall and drainage mapping project and earmarked 35 different outlets to begin IDDE investigations. Sampling is anticipated in summer of 2013. 2) All wet weather sample locations were continued with sampling in the fall of 2012.
Construction Site Stormwater Runoff Control	1) The Town continues to request E&S bonds for all types of development projects over 5 acres and in smaller sensitive locations to help pay for costs of inspection.
Post Construction Stormwater management	1) The Town is working with Dodson Boatyard to install two hydrodynamic separators on the Town owned drainage system in hopes of reducing the amount of sediments and pollutants being deposited into Stonington Harbor during rainfall events. Permits have been obtained from DEEP, but project is on hold due to funding issues 2) All projects are required to be in strict conformance with the 2004 CT Stormwater Quality Manual
Pollution Prevention and Good Housekeeping	1) The DPW swept all 107 miles of road throughout the Town during the summer months.
	2) The Town hired a contractor to vacuum out 896 of the nearly 1500 catch basins throughout the Town in the spring of 2012. Due to budget constraints the remaining basins were not completed in 2013. The Town will continue to budget funds for these operations.

Minimum Measure	Stonington 2012 Annual Report Update
	3) The Town trained employees from the Highway Department, Transfer Station, and the Water Pollution Control Authority on Stormwater Pollution and Prevention with regards to the industrial Permit and the MS4 Permit.

RECOMMENDED NEXT STEPS

As show above, the Town of Stonington has developed and implemented programs to protect water quality from bacterial contamination. Future mitigation activities are necessary to reduce the pathogen contamination in the Pawcatuck watershed. These recommendations will guide interested parties towards the restoration of the impaired waters and ensure the long-term protection of the waters of the Pawcatuck River and have been prioritized below.

1). Identify areas along the more developed portions of the impaired segment of the Pawcatuck River to implement Best Management Practices (BMPs) to control stormwater runoff.

To identify specific areas that are contributing bacteria to the impaired segment, the included towns in the watershed should conduct wet-weather sampling at stormwater outfalls that discharge directly to the Pawcatuck River. To manage stormwater runoff, the towns should also identify areas along the more developed sections of the Pawcatuck River, particularly along the impaired segment, to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the Pawcatuck River. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. Information on potential BMPs and local examples can be reviewed by municipal staff at this DEEP website: www.ct.gov/deep/greeninfrastructure.

The Pawcatuck River Estuary and Little Narragansett Bay Interstate Management Plan suggested that towns within the watershed should develop a comprehensive stormwater management plan to address the stormwater pollution entering the Pawcatuck River (Dillingham et al., 1993). More detailed information and stormwater BMP recommendations can be found in the core TMDL document.

2). Ensure there are sufficient buffers on agricultural lands along Pawcatuck River.

Agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict access to livestock and horses to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located along the impaired segment and along tributary streams of the impaired segment.

3). Develop a system to monitor septic systems.

Many of the residents within the watershed rely on septic systems (Figures 12 and 13). Stonington and North Stonington should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, where resources allow, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify and monitor failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

The Pawcatuck River Estuary and Little Narragansett Bay Interstate Management Plan suggested that the towns within the Pawcatuck River watershed, specifically Stonington, CT and Westerly, RI, undertake an inventory of onsite wastewater treatment systems. The Plan also suggested that these towns establish a priority scheduling of phased replacement of old and failed septic systems and focus on educating citizens on septic system maintenance, septic system failure, and the water quality implications of failed septic systems (Dillingham et al., 1993).

4). Implement a program to evaluate the sanitary sewer system.

Nearly all of the residents and businesses surrounding the Pawcatuck River's freshwater impaired segment in Stonington rely on a municipal sewer system (Figures 12 and 13). Since the sanitary sewer surrounds this impaired segment, ensuring there are no leaks or overflows from the sanitary sewer in this area should be made a priority. It is important for Stonington to develop a program to evaluate its sanitary sewer and reduce leaks and overflows, especially in the areas around the Pawcatuck River's freshwater impaired segment. This program should include periodic inspections of the sewer line.

5). Evaluate municipal education and outreach programs regarding animal waste.

Stonington and North Stonington can take measures to minimize waterfowl-related impacts such as encouraging residents and businesses to allow tall, coarse vegetation to grow in the riparian areas of the impaired segment of the Pawcatuck River that are frequented by waterfowl, particularly within parks and golf courses. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shoreline will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans may contribute to water quality impairments in the Pawcatuck River watershed and can harm human health and the environment. Municipal staff could distribute information regarding feeding waterfowl such as the CT DEEP brochure Do Not Feed Waterfowl http://www.ct.gov/deep/lib/deep/wildlife/pdf_files/game/NoFeedWF.pdf with tax bill inserts or other mailers to residents.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

6). Improve education and outreach programs regarding boats and marinas.

Marinas must comply with permit requirements that limit bacteria contribution to the Pawcatuck Estuary. Other programs, such as Connecticut's Clean Marina Program, may also be adopted by all marinas in the estuary to reduce bacteria contribution from non-point source pollution from marinas (http://www.ct.gov/dep/cwp/view.asp?a=2705&q=323530&depNav_GID=1635). The Clean Marina Program is a voluntary program that encourages inland and coastal marina operators to minimize pollution, and recognizes Connecticut marinas, boatyards, and yacht clubs that go above and beyond regulatory compliance as "Certified Clean Marinas." All certified marinas receive a weatherproof Clean Marina Flag to fly at their facility and authorization to use the Clean Marina Program logo on company publications. CT DEEP recognizes certified Clean Marinas through press releases, on its web page, and at public events. As a companion to the Clean Marina Program, the Clean Boater Program encourages boaters to use clean boating techniques when operating and maintaining their boats. The following marinas in the watershed have obtained Clean Marina Certification: Dodson Boatyard, Connors and O'Brien Marina, and Don's Dock. In addition, Greenhaven Marina and Norwest Marine have both pledged to become Clean Marina certified within the calendar year.

7). Continue monitoring permitted sources.

Currently the available data for the permitted discharges in the Pawcatuck River watershed does not show any high readings of fecal coliform bacteria (Table 7). However, the data for these discharges are only from 2001, 2002, and 2003. More recent data would be beneficial and should be requested of permitees.

If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and additional voluntary measures, that will identify and reduce sources of bacterial contamination at the facility is an additional recommendation. Monitoring should continue on all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within 4 months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established within the TMDL. For the discharges to the impaired waterbody, the municipality must assess the six minimum measures of its plan and modify the plan to implement additional, necessary controls for each appropriate measure. Particular focus should be placed on the following plan components: public education program, illicit discharge detection and elimination (IDDE), stormwater structures cleaning, priority for the repair, upgrade, or retrofit of storm sewer structures. The goal of the modifications is to establish a program to improve water quality consistent with the requirements of the TMDL. If any recorded data that exceed TMDL values are from dry weather monitoring a focus should be on IDDE efforts. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

The following tables detail the appropriate waste load allocations that are established by this TMDL for use as permit limits for permittees as permits are renewed and updated, within the Pawcatuck River watershed and estuary.

Table 11: Bacteria (E. coli) TMDLs, WLAs, and LAs for Recreational Use

Freshwater		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	Bacteria Source	WLA[6]			LA[6]			WLA[6]	LA[6]
	Recreational Use	1	2	3	1	2	3	All	All
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126
B[4]	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of the Core Document deal with BMPs and delineating type of wildlife inputs.

Table 12: Bacteria (Fecal Coliform) TMDLs WLAs, and LAs for Shellfish Harvesting Areas.

		Geometric Mean Fecal coliform (#/100mL)[4]		90th Percentile Statistical measure Fecal Coliform (#/100mL)[4]	
Class	**Bacteria Source[1]**	**WLA**	**LA**	**WLA**	**LA**
SA Direct Consumption	CSOs	14		31	
	SSOs	0		0	
	OBDs[3]	0		0	
	Illicit sewer connection	0		0	
	Leaking sewer lines	0		0	
	Stormwater (MS4s)	14		31	
	Stormwater (non-MS4)		14		31
	Wildlife direct discharge		14		31
	Human or domestic animal direct discharge[2]		14		31
SB Commercial Harvesting	Non-Stormwater NPDES	88		260	
	CSOs	88		260	
	SSOs	0		0	
	OBDs[3]	0		0	
	Illicit sewer connection	0		0	
	Leaking sewer lines	0		0	
	Stormwater (MS4s)	88		260	
	Stormwater (non-MS4)		88		260
	Wildlife direct discharge		88		260
	Human or domestic animal direct discharge[2]		88		260

(1) Criteria are based on utilizing the mTec method as specified in the U.S. Food and Drug Administration National Shellfish Sanitation Program-Model Ordinance (NSSP-MO) document *Guide for the Control of Molluscan Shellfish 2007.*

(2) Human direct discharge = swimmers

(3) All coastal and inland waters in Connecticut are designated as No Discharge Areas for Overboard Discharges (OBDs) from marine vessels with Marine Sanitation Devices.

(4) Adverse Condition Allocations apply to areas affected by Point Sources. Adverse Condition or Random Sampling Allocations apply to areas affected by Nonpoint Sources. Adverse condition is defined as "... a State or situation caused by meteorological, hydrological or seasonal events or point source discharges that has historically resulted in elevated [bacteria] levels in the particular growing area." USFDA 2005

(5) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(6) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of the Core Document deal with BMPs and delineating type of wildlife inputs.

Table 13. Bacteria (Enterococci) TMDLs, WLAs, and LAs for Recreational Uses.

		Instantaneous Enterococcus (#/100mL)				Geometric Mean Enterococcus (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**		**LA[6]**		**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**1**	**3**	**All**	**All**
SA[5]	Illicit sewer connection	0	0			0	
	Leaking sewer lines	0	0			0	
	Stormwater (MS4s)	104[7]	500[7]			35[7]	
	Stormwater (non-MS4)			104[7]	500[7]		35[7]
	Wildlife direct discharge			104[7]	500[7]		35[7]
	Human or domestic animal direct discharge[3]			104	500		35
		Instantaneous Enterococcus (#/100mL)				**Geometric Mean Enterococcus (#/100mL)**	
Class	**Bacteria Source**	**WLA[6]**		**LA[6]**		**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**1**	**3**	**All**	**All**
SB[5]	Non-Stormwater NPDES	104	500			35	
	CSOs	104	500			35	
	SSOs	0	0			0	
	OBDs[4]	0	0			0	
	Illicit sewer connection	0	0			0	
	Leaking sewer lines	0	0			0	
	Stormwater (MS4s)	104[7]	500[7]			35[7]	
	Stormwater (non-MS4)			104[7]	500[7]		35[7]
	Wildlife direct discharge			104[7]	500[7]		35[7]
	Human or domestic animal direct discharge[3]			104	500		35

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

Table 14. Rhode Island Fecal Coliform Targets, Results and Percent Reductions

Rhode Island uses enterococci as an indicator for primary contact recreation / swimming in both freshwaters and salt waters. Rhode Island also uses fecal coliform bacteria as an indicator for determining if waterbodies are meeting the designated use for shellfishing and also for recreation if adequate enterococci data are not available. CT DEEP only utilizes fecal coliform bacteria to determine shellfishing use attainment. For SA waters the water quality criteria for protection of shellfishing uses are the same for both Connecticut and Rhode Island, whereas the SB and recreation pieces have some discrepancies. CT DEEP may have to adjust their SB shellfish geometric mean criteria to be protective of RI DEM water quality standards. There may also need to be a translation of results and criteria for fecal coliform as a recreational standard. A similar translation may be required for freshwater portions of the Pawcatuck as CT DEEP only collects E. coli data and RI DEM utilizes enterococci bacteria.

Pawcatuck River and Little Narragansett Bay Fecal Coliform TMDL Reductions[1]

Station	Segment ID Location	Class	No. Samples	Geometric Mean Target	Geometric Mean Observed	90th Percentile Target	90th Percentile Observed	Percent Reduction[2]
PR4	RI0008038E-01A Pawcatuck River	SB1	13	50	638	300[3]	4156	**94.9** (99.9)
12-1			16		219		780	
12-17			17		222		956	
17A			7		743		5420	
12-2			14		545		3670	
17B			7		903		5840*	
19.6			10		948		5240	
12-3			17		421		2800	
12-4	RI0008038E-01B Pawcatuck River	SB	16	50	238	300[3]	1950	**95.3** (100)
12-5			15		183		1160	
12-6			15		252		2040	
12-7[2]		SB[4]	15	14	110	49	1032*	
12-8	RI0008038E-02A Little Narragansett Bay	SA	12	14	66	49	240*	**79.6** (84.6)
12-9			11		24		240*	
12-10			14		23		93	
12-11			11		7		39	
12-14	RI0008038E-02B Watch Hill Cove	SA{b}	11	14	9	49	43	**87.6** (92.6)
12-15			14		17		196	
12-16			14		43		394*	

[1] Results denoted with a * show that data for that station was used to set the reduction for the segment.
[2] The actual percent reduction is shown in bold. The value in parentheses includes an explicit 5% margin of safety.
[3] The 90th Percentile Target for Class SB/SB1 waters is set to the FDA MPN three-tube variability criterion for the restricted classification of waters to be protective of Connecticut waters.
[4] This station is located on the Class SA line and needs to meet Class SA standards.

Bacteria Data and Percent Reductions to Meet the TMDL

Table 15: Pawcatuck River Bacteria Data

Waterbody ID: CT1000-00_01

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **67%**

Single Sample: **98%**

Data: 2006-2009 from CT DEEP targeted sampling efforts and 2011 CT DEEP targeted efforts
2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Pawcatuck River freshwater segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
254	White Rock Road Bridge at State Line	6/21/2006	220	dry**	112
254	White Rock Road Bridge at State Line	6/28/2006	750	wet**	
254	White Rock Road Bridge at State Line	7/3/2006	125†	dry**	
254	White Rock Road Bridge at State Line	7/11/2006	190	wet**	
254	White Rock Road Bridge at State Line	7/18/2006	110	wet**	
254	White Rock Road Bridge at State Line	7/27/2006	74	wet**	
254	White Rock Road Bridge at State Line	8/2/2006	86	dry**	
254	White Rock Road Bridge at State Line	8/9/2006	36†	dry**	
254	White Rock Road Bridge at State Line	8/16/2006	63	wet**	
254	White Rock Road Bridge at State Line	8/23/2006	190	dry**	
254	White Rock Road Bridge at State Line	9/11/2006	30	dry**	
254	White Rock Road Bridge at State Line	6/6/2007	540	wet	151
254	White Rock Road Bridge at State Line	6/13/2007	110	dry	
254	White Rock Road Bridge at State Line	6/20/2007	95	wet	
254	White Rock Road Bridge at State Line	7/12/2007	63	wet**	
254	White Rock Road Bridge at State Line	7/19/2007	240	wet	
254	White Rock Road Bridge at State Line	7/26/2007	86	dry**	
254	White Rock Road Bridge at State Line	8/9/2007	320	wet	
254	White Rock Road Bridge at State Line	8/23/2007	52	dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
254	White Rock Road Bridge at State Line	9/4/2007	86	dry	
254	White Rock Road Bridge at State Line	9/12/2007	590†	wet	
254	White Rock Road Bridge at State Line	6/4/2008	1400	wet	184
254	White Rock Road Bridge at State Line	6/11/2008	150	dry	
254	White Rock Road Bridge at State Line	6/19/2008	300	wet	
254	White Rock Road Bridge at State Line	6/25/2008	210	dry	
254	White Rock Road Bridge at State Line	7/2/2008	74†	dry	
254	White Rock Road Bridge at State Line	7/9/2008	120	dry	
254	White Rock Road Bridge at State Line	7/16/2008	63	dry	
254	White Rock Road Bridge at State Line	7/23/2008	190	wet	
254	White Rock Road Bridge at State Line	7/30/2008	84	dry	
254	White Rock Road Bridge at State Line	8/6/2008	385†	wet	
254	White Rock Road Bridge at State Line	8/13/2008	640	dry	
254	White Rock Road Bridge at State Line	8/21/2008	52	dry	
254	White Rock Road Bridge at State Line	6/3/2009	74	dry**	116
254	White Rock Road Bridge at State Line	6/11/2009	190	dry	
254	White Rock Road Bridge at State Line	6/25/2009	41	dry**	
254	White Rock Road Bridge at State Line	7/9/2009	410	dry	
254	White Rock Road Bridge at State Line	7/16/2009	110	wet	
254	White Rock Road Bridge at State Line	7/23/2009	170	wet	
254	White Rock Road Bridge at State Line	7/29/2009	41	dry	
254	White Rock Road Bridge at State Line	8/6/2009	63	dry	
254	White Rock Road Bridge at State Line	8/13/2009	150	dry	
254	White Rock Road Bridge at State Line	8/20/2009	250	dry	
254	White Rock Road Bridge at State Line	6/8/2011	120	dry	**384*(67 %)**
254	White Rock Road Bridge at State Line	6/22/2011	160	dry	
254	White Rock Road Bridge at State Line	7/6/2011	74	dry	
254	White Rock Road Bridge at State Line	7/20/2011	120†	dry	
254	White Rock Road Bridge at State Line	8/3/2011	108	dry	
254	White Rock Road Bridge at State Line	8/9/2011	240	wet	
254	White Rock Road Bridge at State Line	8/15/2011	17000	wet	
254	White Rock Road Bridge at State Line	8/17/2011	1100	dry	
254	White Rock Road Bridge at State Line	9/7/2011	2200	wet	
254	White Rock Road Bridge at State Line	9/13/2011	150	dry	
254	White Rock Road Bridge at State Line	9/28/2011	200	dry	
17617	@ Post Office Road	6/8/2011	62	dry	178

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17617	@ Post Office Road	6/22/2011	84	dry	
17617	@ Post Office Road	7/6/2011	110	dry	
17617	@ Post Office Road	7/20/2011	31	dry	
17617	@ Post Office Road	8/3/2011	52	dry	
17617	@ Post Office Road	8/9/2011	110	wet	
17617	@ Post Office Road	8/15/2011	2200	wet	
17617	@ Post Office Road	8/17/2011	1100	dry	
17617	@ Post Office Road	9/7/2011	730	wet	
17617	@ Post Office Road	9/13/2011	96	dry	
17617	@ Post Office Road	9/28/2011	47	dry	
17620	@ Boombridge Road	6/8/2011	52	dry	
17620	@ Boombridge Road	6/22/2011	63	dry	
17620	@ Boombridge Road	7/6/2011	86	dry	
17620	@ Boombridge Road	7/20/2011	41	dry	
17620	@ Boombridge Road	8/3/2011	85	dry	
17620	@ Boombridge Road	8/9/2011	160	wet	
17620	@ Boombridge Road	8/15/2011	8700	wet	
17620	@ Boombridge Road	8/17/2011	1100	dry	
17620	@ Boombridge Road	9/7/2011	1300	wet	
17620	@ Boombridge Road	9/13/2011	146.5†	dry	
17620	@ Boombridge Road	9/28/2011	84	dry	232
17622	@ Alice Court	6/8/2011	74	dry	
17622	@ Alice Court	6/22/2011	120	dry	
17622	@ Alice Court	7/6/2011	85	dry	
17622	@ Alice Court	7/20/2011	74	dry	
17622	@ Alice Court	8/3/2011	200	dry	
17622	@ Alice Court	8/9/2011	170	wet	363
17622	@ Alice Court	8/15/2011	**20500*(98 %)**	wet	
17622	@ Alice Court	8/17/2011	910	dry	
17622	@ Alice Court	9/7/2011	3100	wet	
17622	@ Alice Court	9/13/2011	85	dry	
17622	@ Alice Court	9/28/2011	120	dry	
17623	White Rock Road	6/8/2011	74	dry	
17623	White Rock Road	6/22/2011	130	dry	213
17623	White Rock Road	7/6/2011	85	dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17623	White Rock Road	7/20/2011	57.5†	dry	
17623	White Rock Road	8/3/2011	160	dry	
17623	White Rock Road	8/9/2011	210	wet	
17623	White Rock Road	8/15/2011	>24000	wet	
17623	White Rock Road	8/17/2011	110	dry	
17623	White Rock Road	9/7/2011	2500	wet	
17623	White Rock Road	9/13/2011	85	dry	
17623	White Rock Road	9/28/2011	97	dry	
17626	@ Stillman Avenue	6/8/2011	140	dry	
17626	@ Stillman Avenue	6/22/2011	175	dry	
17626	@ Stillman Avenue	7/6/2011	75	dry	
17626	@ Stillman Avenue	7/20/2011	85	dry	
17626	@ Stillman Avenue	8/3/2011	63	dry	
17626	@ Stillman Avenue	8/9/2011	170	wet	
17626	@ Stillman Avenue	8/15/2011	16000	wet	
17626	@ Stillman Avenue	8/17/2011	880	dry	
17626	@ Stillman Avenue	9/7/2011	2500	wet	
17626	@ Stillman Avenue	9/13/2011	130	dry	
17626	@ Stillman Avenue	9/28/2011	160	dry	339
17628	@ Coggswell Street	6/8/2011	57.5†	dry	
17628	@ Coggswell Street	6/22/2011	120	dry	
17628	@ Coggswell Street	7/6/2011	62	dry	
17628	@ Coggswell Street	7/20/2011	110	dry	
17628	@ Coggswell Street	8/3/2011	240	dry	
17628	@ Coggswell Street	8/9/2011	220	wet	362
17628	@ Coggswell Street	8/15/2011	11000	wet	
17628	@ Coggswell Street	8/17/2011	990	dry	
17628	@ Coggswell Street	9/7/2011	3900	wet	
17628	@ Coggswell Street	9/13/2011	98	dry	
17628	@ Coggswell Street	9/28/2011	200	dry	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for all freshwater monitoring stations on Pawcatuck River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
254/14379	White Rock Road Bridge at State Line	2006-2009, 2011	20	34	166	307	116
17617	@ Post Office Road	2011	3	8	178	561	91
17620	@ Boombridge Road	2011	3	8	232	1219	104
17622	@ Alice Court	2011	3	8	363	2210	134
17623	White Rock Road	2011	3	8	214	725	127
17626	@ Stillman Avenue	2011	3	8	339	1895	144
17628	@ Coggswell Street	2011	3	8	362	2113	147
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport							

Table 16: Segment 7: LIS EB Inner – Pawcatuck River, Stonington Enterococci Data

***Waterbody ID*:** CT- E1_001-SB
Characteristics: Saltwater, Class SB, Commercial Shellfish Harvesting, Habitat for Marine Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply, and Navigation

Impairment: Recreation (enterococci bacteria)

Water Quality Criteria for enterococci:

Geometric Mean: 35 colonies/100 mL

Single Sample: 500 colonies/100 mL (non-designated swimming, no beaches)

Percent Reduction to meet TMDL:

Geometric Mean: **64%**

Single Sample: **83%**

Data: Data from Save the Bay volunteer monitoring efforts between 2010-2013 sampling years.

Single sample enterococci data (colonies/100 mL) from all monitoring stations on Segment 7: LIS EB Inner – Stonington (CT-E1_001-SB) with annual geometric means and reduction goals for samples

Station Name	Station Location	Date	Result	Wet/Dry	Geometric mean
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	5/12/2010	134	wet	**96.72**
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	6/16/2010	52	dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	7/14/2010	1483	wet	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	8/11/2010	30	dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	9/8/2010	132	dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	10/13/2010	20	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	5/11/2011	30	Dry	80.55
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	6/8/2011	121	wet	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	7/6/2011	42	Dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geometric mean
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	8/3/2011	20	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	9/7/2011	**2987***	wet	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	10/5/2011	30	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	5/30/2012	111	Dry	12.44
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	6/27/2012	64	wet	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	7/25/2012	42	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	8/22/2012	1	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	10/17/2012	1	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	5/29/2013	42	wet	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	6/26/2013	31	Unknown*	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	7/24/2013	31	Unknown*	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	8/21/2013	10	Dry	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	9/25/2013	1	Unknown*	
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	10/23/2013	20	Unknown*	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	5/12/2010	41	wet	61.42
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment	6/16/2010	134	Dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geometric mean
	plant outfall				
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	7/14/2010	1576	wet	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	8/11/2010	31	Dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	9/8/2010	20	Dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	10/13/2010	10	Dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	5/11/2011	20	Dry	54.87
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	6/8/2011	97	wet	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	7/6/2011	9	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	8/3/2011	10	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	9/7/2011	2481	wet	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	10/5/2011	63	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	5/30/2012	99	dry	13.17
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	6/27/2012	20	wet	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	7/25/2012	1	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	8/22/2012	10	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	10/17/2012	20	dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geometric mean
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	5/29/2013	42	wet	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	6/26/2013	31	Unknown*	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	7/24/2013	31	Unknown*	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	8/21/2013	1	dry	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	9/25/2013	10	Unknown*	
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	10/23/2013	42	Unknown*	

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
WWTF N (WW442)	Pawcatuck River mainstem north of the Treatment plant outfall	2010-2013	6	13	35.77	240.40	20.90
WWTF S (WW443)	Pawcatuck River mainstem south of the Treatment plant outfall	2010-2013	6	13	30.06	153.46	14.95

Shaded cells indicate an exceedance of water quality criteria
Weather conditions from rain gauges in Groton and Norwich Connecticut (2012 data from Norwich, all others from Groton)
***All unknown precipitation data is not included in the above calculations**

Table 17: Pawcatuck River Tributary (Lewis Brook) Bacteria Data

Waterbody ID: CT1000-01_01

Characteristics: Freshwater, Class A, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **69%**

Single Sample: **98%**

Data: 2011 CTDEEP targeted sampling efforts for TMDL development and investigation

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Lewis Brook segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17619	@ Boom Bridge, North Stonington	6/8/2011	450	Dry	411*
17619	@ Boom Bridge, North Stonington	6/22/2011	96	Dry	
17619	@ Boom Bridge, North Stonington	7/6/2011	230	Dry	
17619	@ Boom Bridge, North Stonington	7/20/2011	200	Dry	
17619	@ Boom Bridge, North Stonington	8/3/2011	150	Dry	
17619	@ Boom Bridge, North Stonington	8/9/2011	1900	Wet	
17619	@ Boom Bridge, North Stonington	8/15/2011	>24000*	Wet	
17619	@ Boom Bridge, North Stonington	8/17/2011	4750	Dry	
17619	@ Boom Bridge, North Stonington	9/7/2011	>24000	Wet	
17619	@ Boom Bridge, North Stonington	9/13/2011	390	Dry	
17619	@ Boom Bridge, North Stonington	9/28/2011	320	Dry	

Wet and dry weather geometric mean values for all freshwater monitoring stations on Lewis Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
17619	@ Boom Bridge North Stonington	2011	3	8	411	1900	340

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport

Table 18: Pawcatuck River Tributary (Lassell's Brook) Bacteria Data

Waterbody ID: CT1000-03_01

Characteristics: Freshwater, Class A, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

***Water Quality Criteria for E. coli*:**

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **81%**

Single Sample: **95%**

Data: 2011 CTDEEP targeted sampling efforts for TMDL development and investigation

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Lassell's Brook segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17624	@ Route 2	6/8/2011	170	Dry	529
17624	@ Route 2	6/22/2011	430	Dry	
17624	@ Route 2	7/6/2011	650	Dry	
17624	@ Route 2	7/20/2011	280	Dry	
17624	@ Route 2	7/26/2011	10	Dry	
17624	@ Route 2	8/3/2011	No water	Dry	
17624	@ Route 2	8/9/2011	1900	Wet	
17624	@ Route 2	8/15/2011	7300	Wet	
17624	@ Route 2	8/17/2011	460	Dry	
17624	@ Route 2	9/7/2011	590	Wet	
17624	@ Route 2	9/13/2011	200	Dry	
17624	@ Route 2	9/28/2011	170	Dry	
17644	@ Fairview Drive	7/26/2011	230	Dry	316
17644	@ Fairview Drive	8/9/2011	990	Wet	
17644	@ Fairview Drive	8/15/2011	3400	Wet	
17644	@ Fairview Drive	8/17/2011	180	Dry	
17644	@ Fairview Drive	9/7/2011	230	Wet	
17644	@ Fairview Drive	9/13/2011	97	Dry	
17644	@ Fairview Drive	9/28/2011	74	Dry	
17645	@ Somerset Drive	7/26/2011	550	Dry	648*
17645	@ Somerset Drive	8/9/2011	110	Wet	
17645	@ Somerset Drive	8/15/2011	4600	Wet	

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17645	@ Somerset Drive	8/17/2011	460	Dry	
17645	@ Somerset Drive	9/7/2011	700	Wet	
17645	@ Somerset Drive	9/13/2011	240	Dry	
17645	@ Somerset Drive	9/28/2011	190	Dry	
17646	@ Timber Ridge Drive	7/26/2011	310	Dry	585
17646	@ Timber Ridge Drive	8/9/2011	740	Wet	
17646	@ Timber Ridge Drive	8/15/2011	7700*	Wet	
17646	@ Timber Ridge Drive	8/17/2011	370	Dry	
17646	@ Timber Ridge Drive	9/7/2011	700	Wet	
17646	@ Timber Ridge Drive	9/13/2011	160	Dry	
17646	@ Timber Ridge Drive	9/28/2011	170	Dry	

Wet and dry weather geometric mean values for all freshwater monitoring stations on Lassell's Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
17624	@ Route 2	2011	3	8	529	2015	298
17644	@ Fairview Drive	2011	3	4	316	918	131
17645	@ Somerset Drive	2011	3	4	648	1524	327
17646	@ Timber Ridge Drive	2011	3	4	585	1585	236

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport

Table 19: Pawcatuck River Tributary (Kelly Brook) Bacteria Data

Waterbody ID: CT1000-04_01

Characteristics: Freshwater, Class A, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **41%**

Single Sample: **91%**

Data: 2011 CTDEEP targeted sampling efforts for TMDL development and investigation

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Kelly Brook segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17625	@ Kelly Road	6/8/2011	110	Dry	214*
17625	@ Kelly Road	6/22/2011	260	Dry	
17625	@ Kelly Road	7/6/2011	170	Dry	
17625	@ Kelly Road	7/20/2011	No water	Dry	
17625	@ Kelly Road	8/3/2011	No Water	Dry	
17625	@ Kelly Road	8/9/2011	440	Wet	
17625	@ Kelly Road	8/15/2011	4600*	Wet	
17625	@ Kelly Road	8/17/2011	160	Dry	
17625	@ Kelly Road	9/7/2011	200	Wet	
17625	@ Kelly Road	9/13/2011	98	Dry	
17625	@ Kelly Road	9/28/2011	31	Dry	

Wet and dry weather geometric mean values for all freshwater monitoring stations on Kelly Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
17625	@ Kelly Road	2011	3	8	214	740	115
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport							

Table 20: Pawcatuck River Tributary (Hyde Brook) Bacteria Data

Waterbody ID: CT1000-05_01

Characteristics: Freshwater, Class A, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **87%**

Single Sample: **96%**

Data: 2011CTDEEP targeted sampling efforts for TMDL development and investigation

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Hyde Brook segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17627	@ Stillman Ave Bridge	6/8/2011	98	Dry	790
17627	@ Stillman Ave Bridge	6/22/2011	1200	Dry	
17627	@ Stillman Ave Bridge	7/6/2011	2900	Dry	
17627	@ Stillman Ave Bridge	7/20/2011	1400	Dry	
17627	@ Stillman Ave Bridge	7/26/2011	310	Dry	
17627	@ Stillman Ave Bridge	8/3/2011	No water	Dry	
17627	@ Stillman Ave Bridge	8/9/2011	3300	Wet	
17627	@ Stillman Ave Bridge	8/15/2011	6500	Wet	
17627	@ Stillman Ave Bridge	8/17/2011	490	Dry	
17627	@ Stillman Ave Bridge	9/7/2011	1600	Wet	
17627	@ Stillman Ave Bridge	9/13/2011	98	Dry	
17627	@ Stillman Ave Bridge	9/28/2011	120	Dry	
17647	@ West Arch Street	7/26/2011	310	Dry	234
17647	@ West Arch Street	8/9/2011	85	Wet	
17647	@ West Arch Street	8/15/2011	6500	Wet	
17647	@ West Arch Street	8/17/2011	200	Dry	
17647	@ West Arch Street	9/7/2011	700	Wet	
17647	@ West Arch Street	9/13/2011	41	Dry	
17647	@ West Arch Street	9/28/2011	52	Dry	
17648	@ Robinson Street	7/26/2011	840	Dry	754
17648	@ Robinson Street	8/9/2011	3300	Wet	
17648	@ Robinson Street	8/15/2011	7700	Wet	
17648	@ Robinson Street	8/17/2011	360	Dry	

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17648	@ Robinson Street	9/7/2011	960	Wet	
17648	@ Robinson Street	9/13/2011	140	Dry	
17648	@ Robinson Street	9/28/2011	150	Dry	
17649	@ Smith Street	8/9/2011	3400	Wet	1006*
17649	@ Smith Street	8/15/2011	10000*	Wet	
17649	@ Smith Street	8/17/2011	260	Dry	
17649	@ Smith Street	9/7/2011	860	Wet	
17649	@ Smith Street	9/13/2011	400	Dry	
17649	@ Smith Street	9/28/2011	340	Dry	

Wet and dry weather geometric mean values for all freshwater monitoring stations on Hyde Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
17627	@ Stillman Ave Bridge	2011	3	8	790	3250	431
17647	@ West Arch Street	2011	3	4	234	729	107
17648	@ Robinson Street	2011	3	4	754	2900	328
17649	@ Smith Street	2011	3	3	1006	3081	282

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport

Table 21: Pawcatuck River Tributary (Iron Brook) Bacteria Data

Waterbody ID: CT1000-00_trib_01

Characteristics: Freshwater, Class A, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (E. coli bacteria)

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **22%**

Single Sample: **84%**

Data: 2011 CTDEEP targeted sampling efforts for TMDL development and investigation

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Iron Brook segment with annual geometric means calculated by station

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
17621	@ Route 49	6/8/2011	41	Dry	161*
17621	@ Route 49	6/22/2011	110	Dry	
17621	@ Route 49	7/6/2011	150	Dry	
17621	@ Route 49	7/20/2011	400	Dry	
17621	@ Route 49	8/3/2011	240	Dry	
17621	@ Route 49	8/9/2011	250	Wet	
17621	@ Route 49	8/15/2011	2600*	Wet	
17621	@ Route 49	8/17/2011	74	Dry	
17621	@ Route 49	9/7/2011	180	Wet	
17621	@ Route 49	9/13/2011	31	Dry	
17621	@ Route 49	9/28/2011	110	Dry	

Wet and dry weather geometric mean values for all freshwater monitoring stations on Iron Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
17621	@ Route 49	2011	3	8	161	489	106

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport

Table 22: Segment 7: LIS EB Inner – Pawcatuck River, Stonington Fecal Coliform Data

Waterbody ID: CT-E1_001-SB

Characteristics: Saltwater, Class SB, Commercial Shellfishing Harvesting, Recreation, Habitat for Marine Fish and other Aquatic Life and Wildlife, Industrial Water Supply, and Navigation

Impairment: Commercial Shellfishing (Fecal coliform)

Water Quality Criteria for Fecal colifom:

Geometric Mean: 88 colonies/100 mL

90% of samples less than: 260 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **98%**

90% of samples less than: **90%**

Data: 2002 – 2007 RIDEM sampling efforts; 2009 - 2011 from CT DEEP and CT DABA targeted sampling efforts, 2012 TMDL Cycle

Single sample Fecal coliform data (colonies/100 mL) from all monitoring stations on Segment 7: LIS EB Inner – Stonington (CT-E1_001-SB) with annual geometric means and reduction goals for samples

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
PR4	Upstream Rhode Island State Boat Ramp	08/02/06	110	Dry	N/A	N/A
PR4	Upstream Rhode Island State Boat Ramp	06/04/07	11000	Wet	796	65
PR4	Upstream Rhode Island State Boat Ramp	06/05/07	930	Wet		
PR4	Upstream Rhode Island State Boat Ramp	06/06/07	750	Wet		
PR4	Upstream Rhode Island State Boat Ramp	06/07/07	930	Wet		
PR4	Upstream Rhode Island State Boat Ramp	06/08/07	230	Wet		
PR4	Upstream Rhode Island State Boat Ramp	07/13/07	230	Dry		
PR4	Upstream Rhode Island State Boat Ramp	07/26/07	930	Dry		
PR4	Upstream Rhode Island State Boat Ramp	08/30/07	460	Dry		
PR4	Upstream Rhode Island State Boat Ramp	08/07/08	460	Wet	635	65
PR4	Upstream Rhode Island State Boat Ramp	09/23/08	23	Dry		
PR4	Upstream Rhode Island State Boat Ramp	09/26/08	3579	Wet		
PR4	Upstream Rhode Island State Boat Ramp	09/27/08	4300	Wet		
PR4	Upstream Rhode Island State Boat Ramp	8/5/2010	25000	Wet	2449	40
PR4	Upstream Rhode Island State Boat Ramp	09/27/10	240	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	07/01/02	150	Dry	406	40
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	08/07/02	1100	Wet		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	06/06/03	390	Dry	N/A	N/A
12-1	Mid-channel opposite red brick building	06/15/05	43	Dry	160	

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
	marked 1890 CB Cottrell + Sons, north of rip-rap wall.					23
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	07/29/05	460	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	09/02/05	210	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	05/31/06	230	Dry	178	10
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	08/01/06	130	Wet		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	08/02/06	140	Wet		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	09/19/06	93	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	09/20/06	460	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	07/13/07	230	Dry	233	N/A
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	07/26/07	230	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	08/30/07	240	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	08/07/08	1100	Wet	217	40
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	09/23/08	43	Dry		
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	8/5/2010	25000	Wet	3278	90
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	09/27/10	430	Dry		

Single sample Fecal coliform data (colonies/100 mL) from all monitoring stations on Segment 7: LIS EB Inner – Stonington (CT-E1_001-SB) with annual geometric means and reduction goals for samples (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-2	At Nun Buoy #26	07/01/02	240	Dry	224	90
12-2	At Nun Buoy #26	08/07/02	210	Wet		
12-2	At Nun Buoy #26	06/06/03	460	Wet	N/A	N/A
12-2	At Nun Buoy #26	06/15/05	460	Dry	541	90
12-2	At Nun Buoy #26	07/29/05	460	Dry		
12-2	At Nun Buoy #26	09/02/05	750	Wet		
12-2	At Nun Buoy #26	05/31/06	460	Dry	541	56
12-2	At Nun Buoy #26	09/19/06	230	Wet		
12-2	At Nun Buoy #26	09/20/06	1500	Wet		
12-2	At Nun Buoy #26	07/13/07	460	Dry	797	56
12-2	At Nun Buoy #26	07/26/07	4600	Dry		
12-2	At Nun Buoy #26	08/30/07	240	Dry		
12-2	At Nun Buoy #26	08/07/08	4600	Wet	830	40
12-2	At Nun Buoy #26	09/23/08	150	Dry		
12-2	At Nun Buoy #26	8/5/2010	4600	Wet	792	40
12-2	At Nun Buoy #26	09/27/10	136.5	Dry		
12-17	From Westerly WWTF plume at outfall	07/01/02	150	Dry	150	N/A
12-17	From Westerly WWTF plume at outfall	08/07/02	150	Wet		
12-17	From Westerly WWTF plume at outfall	06/06/03	240	Wet	N/A	N/A
12-17	From Westerly WWTF plume at outfall	06/15/05	460	Dry	780	90
12-17	From Westerly WWTF plume at outfall	07/29/05	430	Dry		
12-17	From Westerly WWTF plume at outfall	09/02/05	2400	Wet		
12-17	From Westerly WWTF plume at outfall	05/31/06	150	Dry	217	6
12-17	From Westerly WWTF plume at outfall	08/01/06	110	Dry		
12-17	From Westerly WWTF plume at outfall	08/02/06	170	Dry		
12-17	From Westerly WWTF plume at outfall	08/04/06	1700	Dry		
12-17	From Westerly WWTF plume at outfall	09/19/06	93	Wet		
12-17	From Westerly WWTF plume at outfall	09/20/06	240	Wet		
12-17	From Westerly WWTF plume at outfall	07/13/07	150	Dry	92	N/A
12-17	From Westerly WWTF plume at outfall	07/26/07	230	Dry		
12-17	From Westerly WWTF plume at outfall	08/30/07	23	Dry		
12-17	From Westerly WWTF plume at outfall	08/07/08	4600	Wet	190	40
12-17	From Westerly WWTF plume at outfall	09/23/08	93	Dry		
12-17	From Westerly WWTF plume at outfall	8/5/2010	2500	Wet	444	40
12-17	From Westerly WWTF plume at outfall	09/27/10	150	Dry		
17A	Duck Channel West of Major Island	08/04/06	1700	Dry	1257	90
17A	Duck Channel West of Major Island	09/19/06	930	Wet		
17A	Duck Channel West of Major Island	06/04/07	--	Wet	263	56
17A	Duck Channel West of Major Island	07/13/07	460	Dry		
17A	Duck Channel West of Major Island	07/26/07	430	Dry		
17A	Duck Channel West of Major Island	08/30/07	93	Dry		
17A	Duck Channel West of Major Island	08/07/08	11000	Wet	2071	90
17A	Duck Channel West of Major Island	09/23/08	390	Dry		

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
17A	Duck Channel West of Major Island	8/5/2010	2400	Wet	742	40
17A	Duck Channel West of Major Island	09/27/10	230	Dry		
17B	South of Gavitt Point, Near Shore	08/04/06	1700	Wet	1977	90
17B	South of Gavitt Point, Near Shore	09/19/06	2300	Dry		
17B	South of Gavitt Point, Near Shore	09/20/06	--	Dry		
17B	South of Gavitt Point, Near Shore	7/13/07	460	Dry	642	56
17B	South of Gavitt Point, Near Shore	7/26/07	240	Dry		
17B	South of Gavitt Point, Near Shore	8/30/07	240	Dry		
17B	South of Gavitt Point, Near Shore	08/07/08	11000	Wet	687	40
17B	South of Gavitt Point, Near Shore	09/23/08	43	Dry		
17B	South of Gavitt Point, Near Shore	8/5/2010	750	Wet	237	40
17B	South of Gavitt Point, Near Shore	09/27/10	75	Dry		
137-19.6	Pawcatuck WWTF	05/31/06	--	Dry	1121	90
137-19.6	Pawcatuck WWTF	08/01/06	1600	Dry		
137-19.6	Pawcatuck WWTF	08/02/06	350	Dry		
137-19.6	Pawcatuck WWTF	08/04/06	1600	Dry		
137-19.6	Pawcatuck WWTF	09/19/06	430	Wet		
137-19.6	Pawcatuck WWTF	09/20/06	4600	Wet		
137-19.6	Pawcatuck WWTF	06/04/07	--	Wet	918	56
137-19.6	Pawcatuck WWTF	07/13/07	1100	Dry		
137-19.6	Pawcatuck WWTF	07/26/07	11000	Dry		
137-19.6	Pawcatuck WWTF	08/30/07	64	Dry		
137-19.6	Pawcatuck WWTF	08/07/08	4600	Wet	654	40
137-19.6	Pawcatuck WWTF	09/23/08	93	Dry		
137-19.6	Pawcatuck WWTF	08/05/10	2500	Wet	612	40
137-19.6	Pawcatuck WWTF	09/27/10	150	Dry		
PRWW1 -SB1	Connors and O'Brien Boatyard	9/26/08	7500	Wet	**5679***	**90***
PRWW1 -SB1	Connors and O'Brien Boatyard	9/27/08	4600	Wet		
PRWW2 -SB1	Pier 65 Marina	9/26/08	4600	Wet	4447	90
PRWW2 -SB1	Pier 65 Marina	9/27/08	4300	Wet		
Shaded cells indicate an exceedance of water quality criteria ** Weather conditions for selected data from Groton, CT and Westerly R.I. gauge stations. *Indicates geometric mean and single sample values used to calculate the percent reduction						

Wet and dry weather geometric mean values for all monitoring stations on Segment 7: LIS EB Inner – Stonington (CT-E1_001-SB)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
PR4	Upstream Rhode Island State Boat Ramp	2006 - 2010	9	6	763	1878	197
12-1	Mid-channel opposite red brick building marked 1890 CB Cottrell + Sons, north of rip-rap wall.	2002 -2010	7	11	296	726	168
12-2	At Nun Buoy #26	2002 -2010	7	9	571	913	397
12-17	From Westerly WWTF plume at outfall	2002 -2010	5	11	39	101	25
17A	Duck Channel West of Major Island	2002 -2010	3	6	743	2906	376
17B	South of Gavitt Point, Near Shore	2002 -2010	3	6	671	2667	337
19.6	Pawcatuck WWTF	2002 -2010	4	8	882	2184	560
PRWW 1-SB1	Connors and O'Brien Boatyard – Land-based wet weather only station	2008	2	0	5679	5679	--
PRWW 2-SB1	Pier 65 Marina – Land-based wet weather only station	2008	2	0	4447	4447	--
Shaded cells indicate an exceedance of water quality criteria **Weather conditions from rain gauge in Groton, CT and Westerly, R.I.**							

Table 23: Segment 8: LIS EB Inner-Pawcatuck River, Stonington

Waterbody ID: CT-E1_002-SB

Characteristics: Saltwater, Class SB, Commercial Shellfishing Harvesting, Recreation, Habitat for Marine Fish and other Aquatic Life and Wildlife, Industrial Water Supply, and Navigation

Impairment: Shellfish harvesting (fecal coliform bacteria)

Water Quality Criteria for fecal coliform:

Geometric Mean: 88 colonies/100 mL

90% of samples less than : 260 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **98%**

90% of samples less than: **90%**

Data: 2002 – 2011 from RIDEM and DABA sampling efforts and, 2012 TMDL Cycle

Single sample Fecal coliform data (colonies/100 mL) from all monitoring stations on Segment 8: LIS EB Inner-Pawcatuck River, Stonington (CT-E1_002-SB) with annual geometric means and reduction goals for samples

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-3	At Nun Buoy #20	07/01/02	93	Dry	149	N/A
12-3	At Nun Buoy #20	08/07/02	240	Wet		
12-3	At Nun Buoy #20	06/06/03	240	Wet	N/A	N/A
12-3	At Nun Buoy #20	06/15/05	1100	Dry	604	90
12-3	At Nun Buoy #20	07/29/05	460	Dry		
12-3	At Nun Buoy #20	09/02/05	1100	Wet		
12-3	At Nun Buoy #20	05/31/06	43	Dry	295	39
12-3	At Nun Buoy #20	08/01/06	240	Dry		
12-3	At Nun Buoy #20	08/02/06	220	Dry		
12-3	At Nun Buoy #20	08/04/06	1600	Dry		
12-3	At Nun Buoy #20	09/19/06	430	Wet		
12-3	At Nun Buoy #20	09/20/06	430	Wet		
12-3	At Nun Buoy #20	07/13/07	460	Dry	581	57
12-3	At Nun Buoy #20	07/26/07	4600	Dry		
12-3	At Nun Buoy #20	08/30/07	93	Dry		
12-3	At Nun Buoy #20	08/07/08	11000	Wet	1011	40
12-3	At Nun Buoy #20	09/23/08	93	Dry		
12-3	At Nun Buoy #20	8/5/2010	1300	Wet	236	40
12-3	At Nun Buoy #20	09/27/10	43	Dry		
12-4	At Nun Buoy #12	07/01/02	43	Dry	43	N/A

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-4	At Nun Buoy #12	08/07/02	43	Wet		
12-4	At Nun Buoy #12	06/06/03	1500	Wet	N/A	N/A
12-4	At Nun Buoy #12	06/15/05	930	Dry	1008	90
12-4	At Nun Buoy #12	07/29/05	460	Dry		
12-4	At Nun Buoy #12	09/02/05	2400	Wet		
12-4	At Nun Buoy #12	05/31/06	150	Dry	143	30
12-4	At Nun Buoy #12	08/01/06	49	Dry		
12-4	At Nun Buoy #12	08/02/06	79	Dry		
12-4	At Nun Buoy #12	09/19/06	230	Wet		
12-4	At Nun Buoy #12	09/20/06	460	Wet		
12-4	At Nun Buoy #12	07/13/07	150	Dry	107	23
12-4	At Nun Buoy #12	07/26/07	930	Dry		
12-4	At Nun Buoy #12	08/30/07	9	Dry		
12-4	At Nun Buoy #12	08/07/08	11000	Wet	687	40
12-4	At Nun Buoy #12	09/23/08	43	Dry		
12-4	At Nun Buoy #12	8/5/2010	93	Wet	46	N/A
12-4	At Nun Buoy #12	09/27/10	23	Dry		
12-5/ 19.4	At Nun Buoy #8	07/01/02	93	Dry	93	N/A
12-5/ 19.4	At Nun Buoy #8	08/07/02	93	Wet		
12-5/ 19.4	At Nun Buoy #8	06/06/03	1200	Wet	169	10
12-5/ 19.4	At Nun Buoy #8	4/1/2003	70	Dry		
12-5/ 19.4	At Nun Buoy #8	6/10/2003	109	Wet		
12-5/ 19.4	At Nun Buoy #8	6/17/2003	67	Dry		
12-5/ 19.4	At Nun Buoy #8	9/2/2003	224	Wet		
12-5/ 19.4	At Nun Buoy #8	5/5/2004	321	Dry	120	15
12-5/ 19.4	At Nun Buoy #8	6/2/2004	109	Dry		
12-5/ 19.4	At Nun Buoy #8	8/24/2004	224	Dry		
12-5/ 19.4	At Nun Buoy #8	11/15/2004	224	Dry		
12-5/ 19.4	At Nun Buoy #8	06/15/05	1100	Dry	236	30
12-5/ 19.4	At Nun Buoy #8	07/29/05	240	Dry		
12-5/ 19.4	At Nun Buoy #8	09/02/05	2400	Wet		
12-5/ 19.4	At Nun Buoy #8	1/4/2005	32	Wet		
12-5/ 19.4	At Nun Buoy #8	2/7/2005	34	Dry		
12-5/ 19.4	At Nun Buoy #8	05/31/06	75	Dry	89	
12-5/ 19.4	At Nun Buoy #8	08/01/06	79	Dry		

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-5/ 19.4	At Nun Buoy #8	08/02/06	170	Dry		N/A
12-5/ 19.4	At Nun Buoy #8	09/20/06	230	Wet		
12-5/ 19.4	At Nun Buoy #8	4/11/2006	29	Dry		
12-5/ 19.4	At Nun Buoy #8	6/12/2006	81	Dry		
12-5/ 19.4	At Nun Buoy #8	6/21/2006	81	Dry		
12-5/ 19.4	At Nun Buoy #8	06/04/07	--	Wet	84	15
12-5/ 19.4	At Nun Buoy #8	07/13/07	43	Dry		
12-5/ 19.4	At Nun Buoy #8	07/26/07	750	Dry		
12-5/ 19.4	At Nun Buoy #8	08/30/07	9	Dry		
12-5/ 19.4	At Nun Buoy #8	1/2/2007	171	Dry		
12-5/ 19.4	At Nun Buoy #8	08/07/08	460	Wet	76	23
12-5/ 19.4	At Nun Buoy #8	09/23/08	43	Dry		
12-5/ 19.4	At Nun Buoy #8	5/13/2008	22	Dry		
12-5/ 19.4	At Nun Buoy #8	4/7/2009	171	Dry	83	40
12-5/ 19.4	At Nun Buoy #8	5/19/2009	78	Dry		
12-5/ 19.4	At Nun Buoy #8	10/21/2009	72	Dry		
12-5/ 19.4	At Nun Buoy #8	12/7/2009	171	Dry		
12-5/ 19.4	At Nun Buoy #8	8/5/2010	93	Wet	14	N/A
12-5/ 19.4	At Nun Buoy #8	09/27/10	15	Dry		
12-5/ 19.4	At Nun Buoy #8	05/25/2011	170	Dry	N/A	N/A
19.5	At Stonington –on-the-River	2/10/2003	8	Dry	51	40
19.5	At Stonington –on-the-River	9/2/2003	321	Wet		
19.5	At Stonington –on-the-River	3/8/2004	10	Dry	37	N/A
19.5	At Stonington –on-the-River	4/28/2004	137	Wet		
19.5	At Stonington –on-the-River	1/4/2005	96	Wet	87	N/A
19.5	At Stonington –on-the-River	2/7/2005	78	Dry		
19.5	At Stonington –on-the-River	4/11/2006	36	Dry	37	N/A
19.5	At Stonington –on-the-River	10/16/2006	38	Dry		
19.5	At Stonington –on-the-River	1/2/2007	171	Wet	N/A	N/A
19.5	At Stonington –on-the-River	5/13/2008	40	Dry	N/A	N/A
19.5	At Stonington –on-the-River	4/7/2009	171	Wet	132	N/A
19.5	At Stonington –on-the-River	10/21/2009	78	Dry		
19.5	At Stonington –on-the-River	12/7/2009	171	Dry		
12-6	At Can Buoy #7	07/01/02	240	Dry	74	N/A
12-6	At Can Buoy #7	08/07/02	23	Wet		

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-6	At Can Buoy #7	06/06/03	930	Dry	N/A	N/A
12-6	At Can Buoy #7	06/15/05	430	Dry	451	23
12-6	At Can Buoy #7	07/29/05	230	Wet		
12-6	At Can Buoy #7	09/02/05	930	Dry		
12-6	At Can Buoy #7	05/31/06	93	Dry	226	15
12-6	At Can Buoy #7	08/01/06	110	Dry		
12-6	At Can Buoy #7	08/02/06	170	Dry		
12-6	At Can Buoy #7	09/20/06	1500	Wet		
12-6	At Can Buoy #7	07/13/07	75	Dry	198	56
12-6	At Can Buoy #7	07/26/07	2400	Dry		
12-6	At Can Buoy #7	08/30/07	43	Dry		
12-6	At Can Buoy #7	08/07/08	2500	Wet	327	40
12-6	At Can Buoy #7	09/23/08	43	Dry		
12-6	At Can Buoy #7	8/5/2010	93	Wet	46	N/A
12-6	At Can Buoy #7	09/27/10	23	Dry		
12-7	At Nun Buoy #4	07/01/02	43	Dry	13	N/A
12-7	At Nun Buoy #4	08/07/02	4	Wet		
12-7	At Nun Buoy #4	06/06/03	4600	Wet	N/A	N/A
12-7	At Nun Buoy #4	06/15/05	240	Dry	224	56
12-7	At Nun Buoy #4	07/29/05	43	Dry		
12-7	At Nun Buoy #4	09/02/05	1100	Wet		
12-7	At Nun Buoy #4	05/31/06	43	Dry	144	15
12-7	At Nun Buoy #4	08/01/06	130	Dry		
12-7	At Nun Buoy #4	08/02/06	170	Dry		
12-7	At Nun Buoy #4	09/20/06	460	Wet		
12-7	At Nun Buoy #4	07/13/07	43	Dry	42	56
12-7	At Nun Buoy #4	07/26/07	430	Dry		
12-7	At Nun Buoy #4	08/30/07	4	Dry		
12-7	At Nun Buoy #4	08/07/08	930	Wet	118	40
12-7	At Nun Buoy #4	09/23/08	15	Dry		
12-7	At Nun Buoy #4	8/5/2010	43	Wet	30	N/A
12-7	At Nun Buoy #4	09/27/10	21	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	07/01/02	23	Dry	23	

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	08/07/02	23	Wet		N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	06/06/03	--	Wet	44	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	4/30/2003	23	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/10/2003	109	Wet		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/17/2003	36	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	5/5/2004	51	Wet	120	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/2/2004	137	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	8/24/2004	173	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	11/15/2004	173	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	06/15/05	240	Dry	236	
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	07/29/05	23	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	09/02/05	2400	Wet		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	05/31/06	150	Dry	113	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/5/2006	81	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/12/2006	81	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/21/2006	81	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	09/20/06	240	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	06/04/07	--	Wet	39	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	07/13/07	23	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	07/26/07	23	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	08/30/07	9	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/11/2007	171	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/13/2007	116	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	5/14/2008	10	Dry	46	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/18/2008	86	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	08/07/08	240	Dry		

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	09/23/08	23	Wet		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	5/6/2009	171	Dry	83	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	5/19/2009	56	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	6/16/2009	36	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	10/27/2009	140	Wet		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	8/5/2010	29	Wet	14	N/A
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	09/27/10	5.5	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	4/12/2010	18	Dry		
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	5/25/2011	170	Dry	N/A	N/A
2B	Westerly Yacht Club Dock F (RI)	06/04/07	2300	Wet	927	70
2B	Westerly Yacht Club Dock F (RI)	06/05/07	9300	Wet		
2B	Westerly Yacht Club Dock F (RI)	06/06/07	750	Wet		
2B	Westerly Yacht Club Dock F (RI)	06/07/07	460	Wet		
2B	Westerly Yacht Club Dock F (RI)	06/08/07	93	Wet		
2B	Westerly Yacht Club Dock F (RI)	09/26/08	1079	Wet	2154	90
2B	Westerly Yacht Club Dock F (RI)	09/27/08	4300	Wet		
PRWW3SB	Frank Hall Boatyard	9/26/08	930	wet	**3691**	**90**
PRWW3SB	Frank Hall Boatyard	9/27/08	14650	wet		

Wet and dry weather geometric mean values for all monitoring stations on Segment 8: LIS EB Inner-Pawcatuck River, Stonington (CT-E1_002-SB)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
12-3	Westerly Yacht Club Dock F (RI)	2002 - 2011	7	12	396	775	268
12-4	At Nun Buoy #12	2002 - 2011	7	11	198	558	103

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
12-5/19.4	At Nun Buoy #8	2002 - 2011	6	11	152	372	93
12-6	At Can Buoy #7	2002 - 2011	6	11	206	437	137
12-7	At Nun Buoy #4	2002 - 2011	6	11	206	437	137
12-8/19.2	At Flashing Buoy #23, mouth of the Pawcatuck River	2002 - 2011	5	9	52	156	28
2B	Westerly Yacht Club Dock F (RI)	2007-2008	7	0	1180	1180	0
PRWW3SB	Frank Hall Boatyard	2008	2	0	3691	3691	--
19.5	At Stonington –on-the-River	2003-2009	5	8	67	165	38
Shaded cells indicate an exceedance of water quality criteria **Weather conditions from rain gauge in Westerly, R.I. (with selected data taken from Hartford because local station had missing data)**							

Table 24: Segment 9: LIS EB Shore – Wequetequock Cove, Stonington

Waterbody ID: CT-E2_001

Characteristics: Saltwater, Class SA, Shellfishing Harvesting for Direct Human Consumption, Recreation, Habitat for Marine Fish and other Aquatic Life and Wildlife, Industrial Water Supply, and Navigation

Impairment: Shellfish harvesting (fecal coliform bacteria)

Water Quality Criteria for fecal coliform:

Geometric Mean: 14 colonies/100 mL

$90^{\%}$ of samples less than : 31colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **70%**

$90^{\%}$ of samples less than: **56%**

Data: 2006 – 2011 from CT DABA targeted sampling efforts, 2012 TMDL Cycle

Single sample Fecal coliform data (colonies/100 mL) from all monitoring stations on Segment 9: LIS EB Shore – Wequetequock Cove, Stonington (CT-E2_001) with annual geometric means and reduction goals for samples

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
137-18.1	None	6/5/2006	81	Dry	**46**	**56**
137-18.1	None	6/12/2006	43	Dry		
137-18.1	None	6/21/2006	28	Dry		
137-18.1	None	6/11/2007	16	Dry	10	N/A
137-18.1	None	6/13/2007	6	Dry		
137-18.1	None	5/14/2008	2	Dry	3	N/A
137-18.1	None	6/18/2008	4	Dry		
137-18.1	None	5/6/2009	4	Dry	4	N/A
137-18.1	None	5/19/2009	4	Dry		
137-18.1	None	6/16/2009	2	Dry		
137-18.1	None	10/27/2009	12	Wet		
137-18.1	None	4/12/2010	6	Dry	N/A	N/A
137-18.1	None	5/25/2011	86	Dry	86	90
137-18.2	None	6/12/2006	26	Dry	N/A	N/A
137-18.2	None	6/11/2007	10	Dry		N/A
137-18.2	None	6/13/2007	10	Dry	10	
137-18.2	None	5/14/2008	1	Dry	2	N/A

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
137-18.2	None	6/18/2008	22	Dry		
137-18.2	None	5/6/2009	8	Dry	4	N/A
137-18.2	None	5/19/2009	4	Dry		
137-18.2	None	6/16/2009	2	Dry		
137-18.2	None	10/27/2009	4	Wet		
137-18.2	None	4/12/2010	14	Dry	N/A	N/A
137-18.2	None	5/25/2011	74	Dry	N/A	N/A

Wet and dry weather geometric mean values for all monitoring stations on Segment 9: LIS EB Shore – Wequetequock Cove, Stonington (CT-E2_001)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
137-18.1	None	2006 - 2011	1	12	10.3	12	10.2
137-18.2	None	2006 - 2011	1	10	8.42	4	9.0

Shaded cells indicate an exceedance of water quality criteria
Weather conditions from rain gauge in Groton, CT and Westerly R.I.

Table 25: Segment 10: LIS EB Midshore, Stonington

Waterbody ID: CT-E3_001
Characteristics: Saltwater, Class SA, Shellfishing Harvesting for Direct Human Consumption, Recreation, Habitat for Marine Fish and other Aquatic Life and Wildlife, Industrial Water Supply, and Navigation
Impairment: Shellfish Harvesting (fecal coliform bacteria)

***Water Quality Criteria for fecal coliform*:**
Geometric Mean: 14 colonies/100 mL
90% of samples less than : 31colonies/100 mL

***Percent Reduction to meet TMDL*:**
Geometric Mean: **82%**
90% of samples less than: **90%**

Data: 2006 – 2011 from CT DEEP and CT DABA targeted sampling efforts, 2012 TMDL Cycle

Single sample fecal coliform data (colonies/100 mL) from all monitoring stations on Segment 10: LIS EB Midshore, Stonington (CT-E3_001) with annual geometric means and reduction goals

Station Name	Station Location	Date	Result	Wet/Dry	Geo Mean	Reduction of Exceeding Samples
137-19.1	West of Pawcatuck Point (CT)	6/5/2006	81	Dry	**78**	**90**
137-19.1	West of Pawcatuck Point (CT)	6/12/2006	73	Dry		
137-19.1	West of Pawcatuck Point (CT)	6/21/2006	81	Dry		
137-19.1	West of Pawcatuck Point (CT)	6/11/2007	116	Dry	30	40
137-19.1	West of Pawcatuck Point (CT)	6/13/2007	8	Dry		
137-19.1	West of Pawcatuck Point (CT)	5/14/2008	4	Dry	11	N/A
137-19.1	West of Pawcatuck Point (CT)	6/18/2008	34	Dry		
137-19.1	West of Pawcatuck Point (CT)	5/6/2009	106	Dry	14	65
137-19.1	West of Pawcatuck Point (CT)	5/19/2009	8	Dry		
137-19.1	West of Pawcatuck Point (CT)	6/16/2009	2	Dry		
137-19.1	West of Pawcatuck Point (CT)	10/27/2009	28	Wet		
137-19.1	West of Pawcatuck Point (CT)	4/12/2010	22	Dry	N/A	N/A
137-19.1	West of Pawcatuck Point (CT)	5/25/2011	82	Dry	N/A	

Wet and dry weather geometric mean values for all monitoring stations on Segment 10: LIS EB Midshore, Stonington (CT-E3_001)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
137-19.1	West of Pawcatuck Point (CT)	2006 - 2011	1	12	28	28	27

Shaded cells indicate an exceedance of water quality criteria
Weather conditions from rain gauge in Stamford, CT (with selected data taken from Hartford because local station had missing data)

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APPENDIX 1. FRESHWATER ENTEROCOCCI RESULTS

This table displays the enterococci data collected during targeted sampling efforts by CT DEEP and RIDEM. CT DEEP has no comparative criteria in the CT WQS for enterococci for freshwater streams. RIDEM utilizes single sample maximum criteria of 61 cols/100mls and a geometric mean of 54 cols/100mls for non-designated bathing beaches. The data shows that all of the monitored tributaries are contributing enterococci loads to the mainstem of the Pawcatuck River. All values that are displayed in blue font are averages of duplicate samples and pink font are equivalent to To Numerous To Count (TNTC) samples.

Station Name	Station Location	Date	Result (cols/100mls)	Wet/Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**6/22/2011**	79.8	Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**7/6/2011**	33.2	Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**8/3/2011**	49.6	Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**9/13/2011**	93.3	Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**9/28/2011**	**56.5**	Dry
17617	Pawcatuck River at Stateline, Post Office Lane	**8/15/2011**	>2419.2	Wet
17617	Pawcatuck River at Stateline, Post Office Lane	**8/17/2011**	613.1	Wet
17619	Lewis Brook at Boon Bridge Road	**6/22/2011**	436	Dry
17619	Lewis Brook at Boon Bridge Road	**7/6/2011**	344.8	Dry
17619	Lewis Brook at Boon Bridge Road	**8/3/2011**	145.5	Dry
17619	Lewis Brook at Boon Bridge Road	**9/13/2011**	116.4	Dry
17619	Lewis Brook at Boon Bridge Road	**9/28/2011**	76.8	Dry
17619	Lewis Brook at Boon Bridge Road	**8/15/2011**	>2419.2	Wet
17619	Lewis Brook at Boon Bridge Road	**8/17/2011**	1390	Wet
17620	Pawcatuck River at Boon Bridge Road	**6/22/2011**	65	Dry
17620	Pawcatuck River at Boon Bridge Road	**7/6/2011**	26.5	Dry
17620	Pawcatuck River at Boon Bridge Road	**8/3/2011**	31.3	Dry
17620	Pawcatuck River at Boon Bridge Road	**9/13/2011**	**92.35**	Dry
17620	Pawcatuck River at Boon Bridge Road	**9/28/2011**	104.6	Dry
17620	Pawcatuck River at Boon Bridge Road	**8/15/2011**	>2419.2	Wet
17620	Pawcatuck River at Boon Bridge Road	**8/17/2011**	648.8	Wet
17620	Pawcatuck River at Boon Bridge Road	**5/12/2011**	77.1	Dry
17620	Pawcatuck River at Boon Bridge Road	**6/28/11**	38.2	Dry
17620	Pawcatuck River at Boon Bridge Road	**7/21/11**	46.4	Dry

Station Name	Station Location	Date	Result (cols/100mls)	Wet/Dry
17620	Pawcatuck River at Boon Bridge Road	**8/24/11**	33.2	Dry
17620	Pawcatuck River at Boon Bridge Road	**9/28/11**	78.9	Dry
17629	Shunock River at Route 49	**6/22/2011**	488	Dry
17629	Shunock River at Route 49	**7/6/2011**	59.1	Dry
17629	Shunock River at Route 49	**8/3/2011**	152.9	Dry
17629	Shunock River at Route 49	**9/13/2011**	82.3	Dry
17629	Shunock River at Route 49	**9/28/2011**	165.8	Dry
17629	Shunock River at Route 49	**8/15/2011**	>2419.2	Wet
17629	Shunock River at Route 49	**8/17/2011**	980.4	Wet
17621	Iron Brook at Route 49	**6/22/2011**	209.1	Dry
17621	Iron Brook at Route 49	**7/6/2011**	128.1	Dry
17621	Iron Brook at Route 49	**8/3/2011**	166.9	Dry
17621	Iron Brook at Route 49	**9/13/2011**	58.2	Dry
17621	Iron Brook at Route 49	**9/28/2011**	179.3	Dry
17621	Iron Brook at Route 49	**8/15/2011**	>2419.2	Wet
17621	Iron Brook at Route 49	**8/17/2011**	146.7	Wet
17622	Pawcatuck River at Alice Court	**6/22/2011**	116.9	Dry
17622	Pawcatuck River at Alice Court	**7/6/2011**	30.1	Dry
17622	Pawcatuck River at Alice Court	**8/3/2011**	38.4	Dry
17622	Pawcatuck River at Alice Court	**9/13/2011**	86.7	Dry
17622	Pawcatuck River at Alice Court	**9/28/2011**	55.4	Dry
17622	Pawcatuck River at Alice Court	**8/15/2011**	>2419.2	Wet
17622	Pawcatuck River at Alice Court	**8/17/2011**	816.4	Wet
14379	Pawcatuck River at White Rock Bridge	**6/22/2011**	83.9	Dry
14379	Pawcatuck River at White Rock Bridge	**7/6/2011**	58.1	Dry
14379	Pawcatuck River at White Rock Bridge	**8/3/2011**	**34.2**	Dry
14379	Pawcatuck River at White Rock Bridge	**5/10/11**	6.3	Dry
14379	Pawcatuck River at White Rock Bridge	**6/27/11**	66.3	Dry

Station Name	Station Location	Date	Result (cols/100mls)	Wet/Dry
14379	Pawcatuck River at White Rock Bridge	**7/20/11**	21.1	Dry
14379	Pawcatuck River at White Rock Bridge	**8/18/11**	108	Wet
14379	Pawcatuck River at White Rock Bridge	**9/27/11**	52	Dry
14379	Pawcatuck River at White Rock Bridge	**9/13/2011**	72.3	Dry
14379	Pawcatuck River at White Rock Bridge	**9/28/2011**	69.7	Dry
14379	Pawcatuck River at White Rock Bridge	**8/15/2011**	>2419.2	Wet
14379	Pawcatuck River at White Rock Bridge	**8/17/2011**	770.1	Wet
17630	Pawcatuck River Canal at Canal Access Road	**6/22/2011**	110.6	Dry
17630	Pawcatuck River Canal at Canal Access Road	**7/6/2011**	9.7	Dry
17630	Pawcatuck River Canal at Canal Access Road	**8/3/2011**	101.2	Dry
17630	Pawcatuck River Canal at Canal Access Road	**9/13/2011**	47.4	Dry
17630	Pawcatuck River Canal at Canal Access Road	**9/28/2011**	49.6	Dry
17630	Pawcatuck River Canal at Canal Access Road	**8/15/2011**	>2419.2	Wet
17630	Pawcatuck River Canal at Canal Access Road	**8/17/2011**	816.4	Wet
17623	Pawcatuck River below Canal	**6/22/2011**	195.6	Dry
17623	Pawcatuck River below Canal	**7/6/2011**	37.9	Dry
17623	Pawcatuck River below Canal	**8/3/2011**	67.6	Dry
17623	Pawcatuck River below Canal	**9/13/2011**	137.6	Dry
17623	Pawcatuck River below Canal	**9/28/2011**	79.4	Dry
17623	Pawcatuck River below Canal	**8/15/2011**	>2419.2	Wet
17623	Pawcatuck River below Canal	**8/17/2011**	579.4	Wet
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**6/22/2011**	1732.9	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**7/26/2011**	830	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**7/6/2011**	1553.7	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**8/3/2011**	DRY	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**9/13/2011**	980.4	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**9/28/2011**	387.3	Dry
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**8/15/2011**	>2419.2	Wet
17624	Lassel’s Brook at Lassel's Carpet Store, Route 2	**8/17/2011**	1553.1	Wet

Station Name	Station Location	Date	Result (cols/100mls)	Wet/Dry
17625	Kelly Brook at Kelly Road	**6/22/2011**	211	Dry
17625	Kelly Brook at Kelly Road	**7/6/2011**	98.4	Dry
17625	Kelly Brook at Kelly Road	**8/3/2011**	DRY	Dry
17625	Kelly Brook at Kelly Road	**9/13/2011**	178.2	Dry
17625	Kelly Brook at Kelly Road	**9/28/2011**	108.1	Dry
17625	Kelly Brook at Kelly Road	**8/15/2011**	>2419.2	Wet
17625	Kelly Brook at Kelly Road	**8/17/2011**	290.9	Wet
17626	Pawcatuck River at Stillmanville Avenue	**6/22/2011**	967	Dry
17626	Pawcatuck River at Stillmanville Avenue	**7/6/2011**	**47.95**	Dry
17626	Pawcatuck River at Stillmanville Avenue	**8/3/2011**	52	Dry
17626	Pawcatuck River at Stillmanville Avenue	**9/13/2011**	105	Dry
17626	Pawcatuck River at Stillmanville Avenue	**9/28/2011**	111.9	Dry
17626	Pawcatuck River at Stillmanville Avenue	**8/15/2011**	>2419.2	Wet
17626	Pawcatuck River at Stillmanville Avenue	**8/17/2011**	816.4	Wet
17627	Hyde Brook at Stillmanville Avenue	**6/22/2011**	95.9	Dry
17627	Hyde Brook at Stillmanville Avenue	**7/6/2011**	2419.17	Dry
17627	Hyde Brook at Stillmanville Avenue	**8/3/2011**	DRY	Dry
17627	Hyde Brook at Stillmanville Avenue	**9/13/2011**	579.4	Dry
17627	Hyde Brook at Stillmanville Avenue	**9/28/2011**	1299.65	Dry
17627	Hyde Brook at Stillmanville Avenue	**8/15/2011**	>2419.2	Wet
17627	Hyde Brook at Stillmanville Avenue	**7/26/2011**	98	Dry
17627	Hyde Brook at Stillmanville Avenue	**8/17/2011**	1413.6	Wet
17628	Pawcatuck River at Coggswell Street	**6/22/2011**	175	Dry
17628	Pawcatuck River at Coggswell Street	**7/6/2011**	20	Dry
17628	Pawcatuck River at Coggswell Street	**8/3/2011**	121	Dry
17628	Pawcatuck River at Coggswell Street	**9/13/2011**	104.3	Dry
17628	Pawcatuck River at Coggswell Street	**9/28/2011**	187.2	Dry
17628	Pawcatuck River at Coggswell Street	**8/15/2011**	>2419.2	Wet
17628	Pawcatuck River at Coggswell Street	**8/17/2011**	579.4	Wet
17644	Lassell's Brook @ Fairview Dr.	**7/26/2011**	930	Dry

Station Name	Station Location	Date	Result (cols/100mls)	Wet/Dry
17645	Lassell's Brook @ Somersett Dr.	**7/26/2011**	840	Dry
17646	Lassell's Brook @ Timber Ridge Dr.	**7/26/2011**	620	Dry
17647	Hyde Brook @ West Arch St.	**7/26/2011**	290	Dry
17648	Hyde Brook @ Robinson St.	**7/26/2011**	1000	Dry

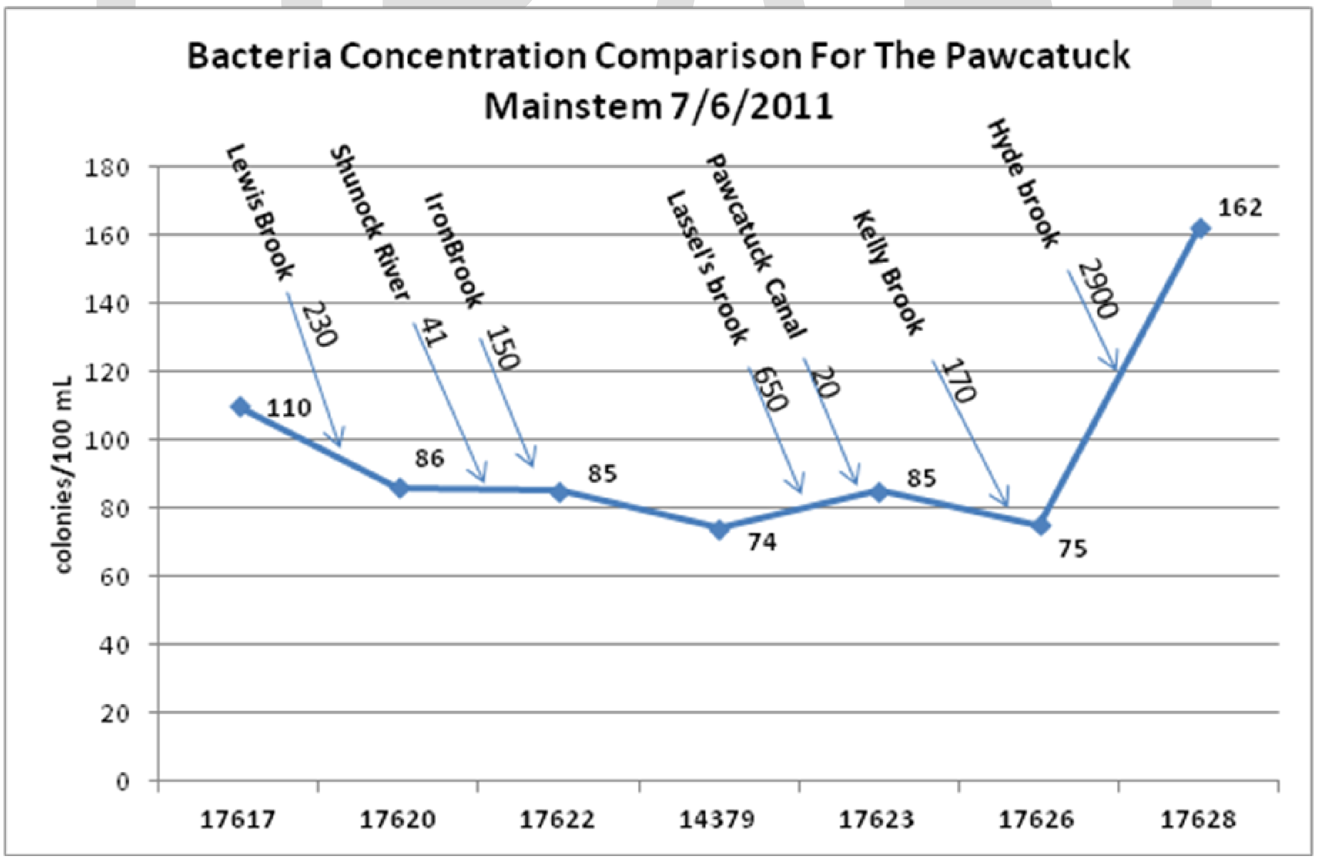
APPENDIX 2. E.COLI MASS ANALYSIS OF FRESHWATER DATA

The Pawcatuck River is a waterbody of significant size and volume. CT DEEP staff conducted an analysis of the bacteria loading on a mass basis in the Pawcatuck watershed. This analysis allows for an additional comparison of sources and significance of bacteria loads in the basin. To accomplish this analysis, DEEP staff utilized USGS Stream Stats mapping software http://water.usgs.gov/osw/streamstats/connecticut.html to estimate flow rates for the tributaries and at sampling station locations on the Pawcatuck River mainstem. These flow volumes were multiplied by bacteria concentrations and a conversion factor to account for a change in units between ft^3 and ml.

FLOW VOLUME (FT^3/SEC) * E.COLI CONCENTRATION (COLS/100ML) * 28316 ML/1FT^3 = BACTERIA MASS LOAD (COLS/SEC)

The resulting values are the number of e.coli colonies per second at a sampling location on a sampling trip date. One set of dry weather data and one set of wet weather data was analyzed with this process. Data was analyzed using MS Excel spreadsheet formulas. The resultant charts are included in this appendix for the TMDL document. One additional chart has been included that shows direct colony count concentrations at the same locations and sample date as the dry weather bar chart (7-6-2011).

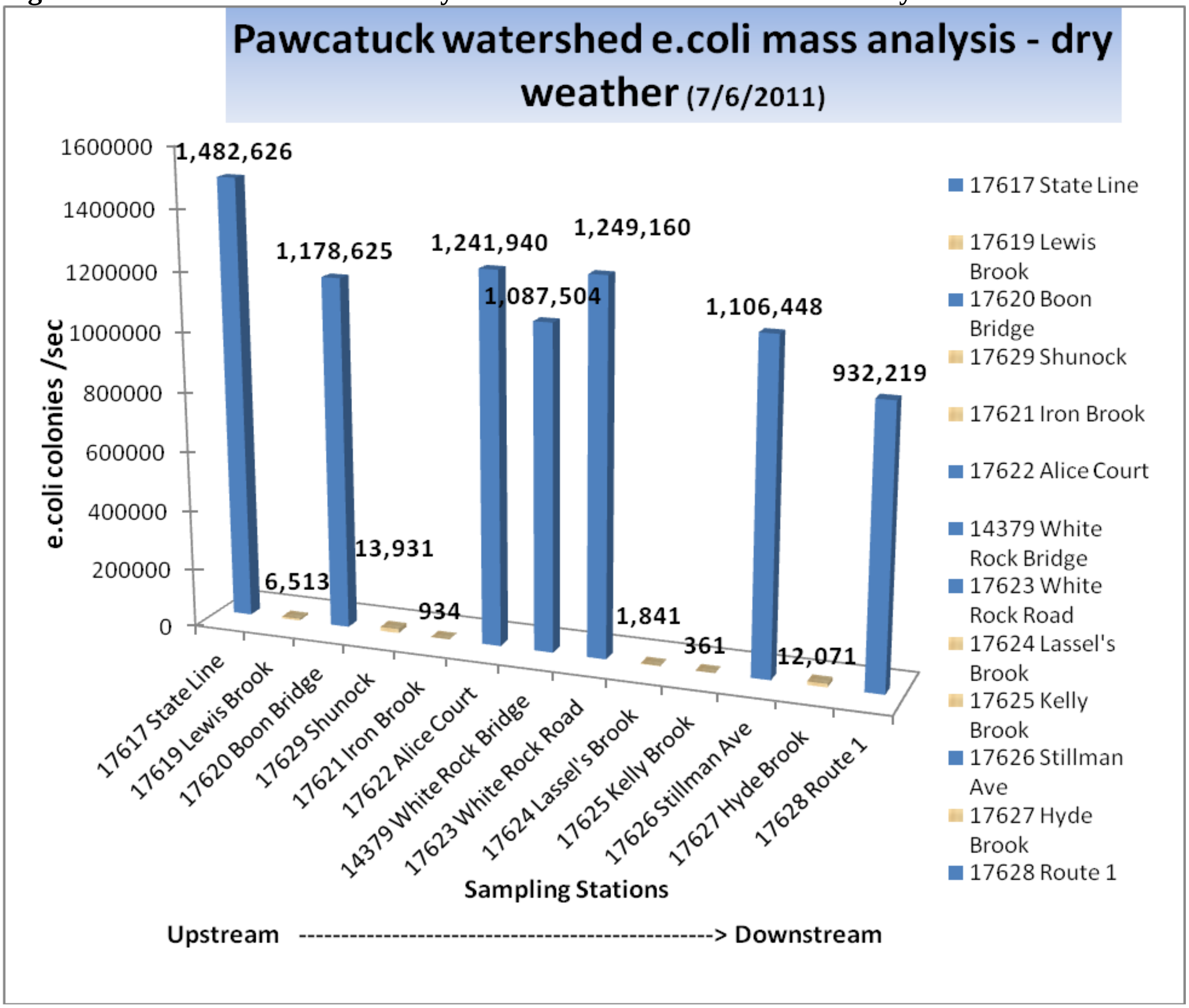
Figure 21. Chart of e.coli concentrations in the Pawcatuck River



The line graph shows e.coli results on stations along the mainstem of the Pawcatuck River. Station 17617 is the most upstream station at the State border and station 17628 is at Route 1 at the Westerly and

Stonington border. All tributaries point towards the location where they enter the Pawcatuck River as the river flows towards Long Island Sound. Colony count concentrations for the tributaries are included on the arrows. By only reviewing the concentration data for the tributaries, which show larger concentrations than the mainstem, it would appear that a significant source of bacteria load is from these smaller streams. In fact the largest concentration collected on 7/6/2011 came from Hyde Brook with 2900 cols/100mls. Adding in the factor of flow volumes, paints a dramatically different picture of the same data.

Figure 22. Chart of e.coli mass analysis in the Pawcatuck Watershed –dry weather



When the flow volumes are added into the equation, the loading of the tributaries is shown to be a minimal input. In the above graph, the blue bars are representing the mainstem Pawcatuck stations and the beige stations are the tributaries. The values are for number of e.coli colonies per second at each sampling station. The graph moves from upstream to downstream in a left to right pattern. Station 17617 is located at the State border with Rhode Island. This location can be used to represent water quality in the river as it flows into Connecticut. During dry weather flows the driver for impairment is the Rhode Island inputs before it reaches Connecticut. These loads are not a surprise as Rhode Island is also issuing TMDLs for their portions of the Pawcatuck River. While Connecticut doesn't utilize mass based criteria, this analysis is very useful in determining where implementation efforts may have the most impact on the mainstem of the Pawcatuck River.

Figure 23. Chart of e.coli mass analysis in Pawcatuck Watershed – wet weather

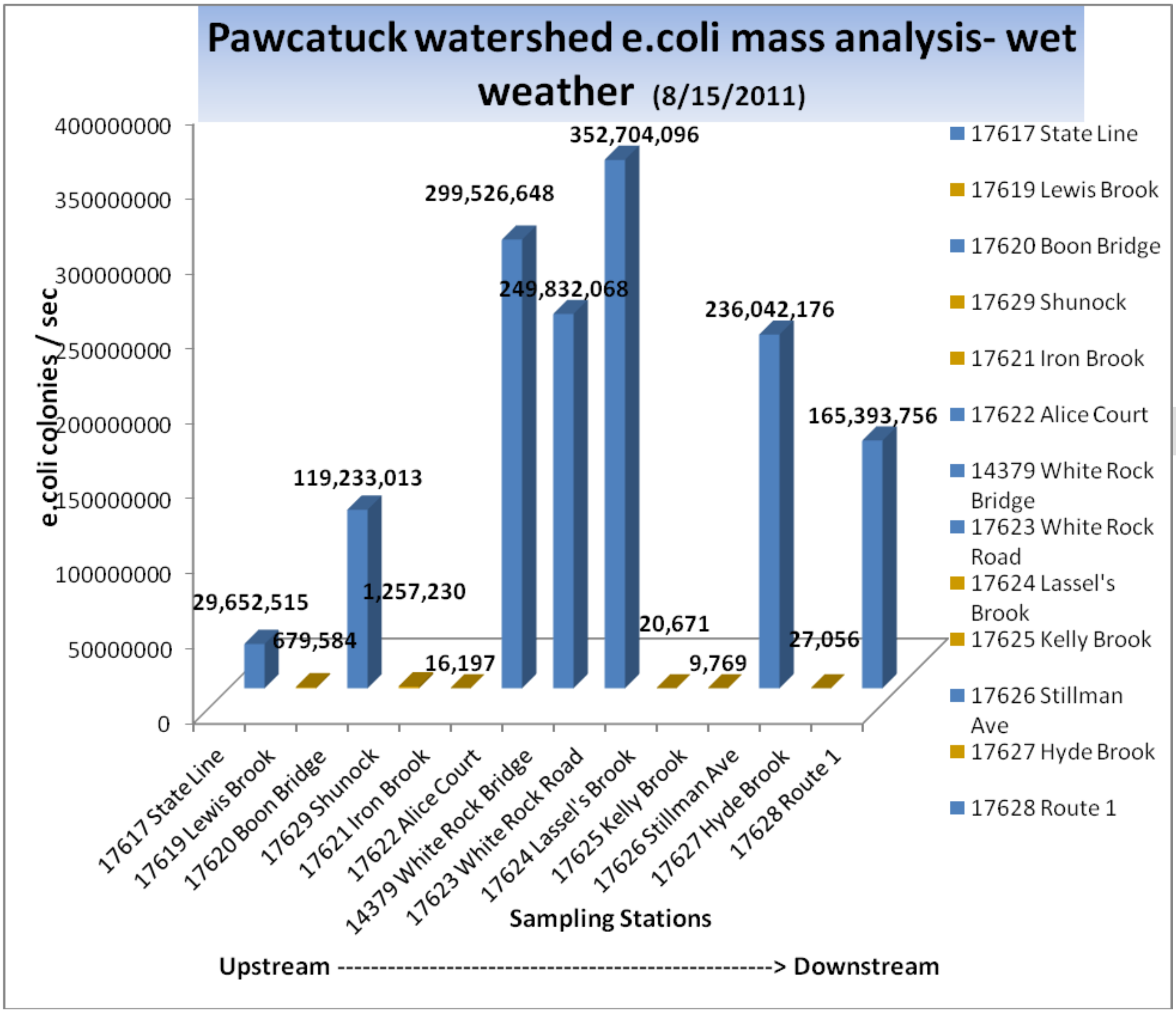


Figure 23 is the same sampling of stations and chart formatting as the dry weather mass analysis graph. The only difference is that 8-15-2011 is a wet weather sampling date. While again the Pawcatuck River loads are much higher than the tributaries, all mass values have increased over the dry weather sampling event from 7-06-2011. An interesting point to make on the results of this analysis is that the mass values increase dramatically at station 14379, which is very close to where the urban development and impervious cover levels increase dramatically on aerial maps of the watershed and sampling areas. So during wet weather flows the impairment is likely driven by urban stormwater carrying increased bacteria loads in the developed portions of Stonington and Westerly in the watershed.

APPENDIX 3. FRESHWATER CHEMISTRY RESULTS FROM TARGETED SAMPLING EFFORTS

There were three sampling trips conducted in the Pawcatuck River Watershed by CT DEEP to collect and analyze samples for general chemistry and metals. Table 1 and Table 2 summarize the freshwater results of those collections. Rhode Island DEM has impaired the Pawcatuck River segment RI0008039R-18E for lead and iron. This segment runs from the Route 3 bridge crossing to the Route 1 bridge in Westerly, RI.

CT DEEP monitoring data from freshwater sampling locations are included below. Most results show no impairments or water quality issues as they are below the detection limit for the test conducted on the sample. There are a few exceptions to this statement where the results not only are detectable but also exceed water quality criteria. Those stations have been highlighted in the following tables. For the comparisons with CT Water Quality Standards the dissolved fraction of the metals is the value that has a direct comparison with criteria. In the following tables red highlights indicate an exceedance of chronic CT Water Quality Standards for aluminum of 87µg/L. The yellow highlights indicate an exceedance of chronic CT Water Quality Standards for lead of 1.2µg/L. The magenta highlights indicate an exceedance of the chronic NOAA SQuiRTs screening values for iron 1000 µg/L, there are no CT Water Quality Standards values for iron.

In reviewing these exceedances it appears that Iron Brook is aptly named with large concentrations of iron results in all collected samples. Hyde Brook and Kelly Brook are additional tributaries to the Pawcatuck that also contain exceedances for iron in collected samples. With additional sampling to bolster the data set it is possible that these streams will have impairments for Aquatic Life Use Support (ALUS). There are no sample results that exceed any of the acute criteria for the constituents where there are chronic exceedances. No other constituents exceeded available criteria in the data set generated by these sampling efforts. There are no samples or stations on the Pawcatuck mainstem that exhibited exceedances for any of the measured parameters during these monitoring trips in the Pawcatuck watershed.

It is difficult to conclude that these streams are impaired for ALUS due to the exceeding metals due to the small nature of the dataset. Additional follow up monitoring at the impacted stations may result in a clearer picture of the water quality of these streams.

Table 3A. Freshwater General Chemistry Results

Sta. ID #	Site	Landmark	Town	Date	TSS mg/L	Turb.	pH Units	NH4 mg/L	Alk. mg/L	Hard. mg/L	Chloride mg/L	NO3 mg/L	NO2 mg/L	T Phosphorous mg/L	O-Phosphate mg/L
14379	Pawcatuck River	@White Rock Brdg	Ston.	6/22/2011	<4.0	1	7	<0.05	10	18	20	0.4	<0.1	<0.04	<0.25
14379	Pawcatuck River	@White Rock Brdg	Ston.	7/20/2011	<4.0	0.68	7.2	<0.05	12	19	20	0.6	<0.1	<0.04	<0.25
14379	Pawcatuck River	@White Rock Brdg	Ston.	9/7/2011	5	1.2	6.8	<0.05	10	17	16	0.3	<0.1	<0.04	<0.25

Sta. ID #	Site	Landmark	Town	Date	TSS mg/L	Turb.	pH Units	NH4 mg/L	Alk. mg/L	Hard. mg/L	Chloride mg/L	NO3 mg/L	NO2 mg/L	T Phosphorous mg/L	O-Phosphate mg/L
17617	Pawcatuck River	@ Post Office Rd.	No Ston	6/22/2011	<4.0	1.2	6.9	<0.05	<10	16	20	0.4	<0.1	<0.04	<0.25
17617	Pawcatuck River	@ Post Office Rd.	No Ston	7/20/2011	<4.0	0.97	7	<0.05	11	17	20	0.5	<0.1	0.05	<0.25
17617	Pawcatuck River	@ Post Office Rd.	No Ston	9/7/2011	<4.0	1.4	6.8	<0.05	9	15	18	0.3	<0.1	0.04	<0.25
17619	Lewis Brook	@ Boom Bridge	No Ston	6/22/2011	<4.0	1.6	7.3	<0.05	18	37	24	1	<0.1	0.04	<0.25
17619	Lewis Brook	@ Boom Bridge	No Ston	7/20/2011	<4.0	1.5	7.4	<0.05	19	41	24	1	<0.1	0.05	<0.25
17619	Lewis Brook	@ Boom Bridge	No Ston	9/7/2011	9	4.7	6.9	<0.05	14	25	21	0.5	<0.1	0.21	<0.25
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	6/22/2011	<4.0	1.1	6.9	<0.05	<10	16	20	0.4	<0.1	<0.04	<0.25
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	7/20/2011	10	0.95	6.9	<0.05	11	18	20	0.6	<0.1	0.04	<0.25
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	9/7/2011	<4.0	1.2	6.8	<0.05	9	16	17	0.3	<0.1	<0.04	<0.25
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	9/7 DUP	8	1.1	6.8	<0.05	9	15	17	0.3	<0.1	<0.04	<0.25
17621	Iron Brook	@ Rte. 49	Ston.	6/22/2011	6	24	7.3	<0.05	28	37	30	<0.1	<0.1	<0.04	<0.25
17621	Iron Brook	@ Rte. 49	Ston.	7/20/2011	4	33	7.2	0.32	28	37	32	<0.1	<0.1	<0.04	<0.25
17621	Iron Brook	@ Rte. 49	Ston.	9/7/2011	33	15	6.8	0.07	20	27	25	<0.1	<0.1	<0.04	<0.25
17622	Pawcatuck River	@ Alice Court	Ston.	6/22/2011	<4.0	1	7	<0.05	11	19	20	0.5	<0.1	<0.04	<0.25
17622	Pawcatuck River	@ Alice Court	Ston.	7/20/2011	<4.0	0.76	7.1	<0.05	12	20	20	0.6	<0.1	0.04	<0.25
17622	Pawcatuck River	@ Alice Court	Ston.	9/7/2011	<4.0	1.5	6.9	<0.05	11	18	16	0.3	<0.1	<0.04	<0.25
17623	Pawcatuck River	White Rock Rd., RI	Ston.	6/22/2011	<4.0	1.1	7	<0.05	10	17	20	0.5	<0.1	<0.04	<0.25

Sta. ID #	Site	Landmark	Town	Date	TSS mg/L	Turb.	pH Units	NH4 mg/L	Alk. mg/L	Hard. mg/L	Chloride mg/L	NO3 mg/L	NO2 mg/L	T Phosphorous mg/L	O-Phosphate mg/L
17623	Pawcatuck River	White Rock Rd., RI	Ston.	7/20/2011	<4.0	0.69	7.2	<0.05	11	19	20	0.6	<0.1	<0.04	<0.25
17623	Pawcatuck River	White Rock Rd., RI	Ston.	7/20DUP	<4.0	0.78	7.2	<0.05	11	19	20	0.6	<0.1	<0.04	<0.25
17623	Pawcatuck River	White Rock Rd., RI	Ston.	9/7/2011	5	1.1	6.8	<0.05	9	17	17	0.3	<0.1	<0.04	<0.25
17624	Lassell's Br.	@ Rte 2	Ston.	6/22/2011	16	2.2	7.4	<0.05	20	38	30	1.3	<0.1	<0.04	<0.25
17624	Lassell's Br.	@ Rte 2	Ston.	7/20/2011	70	4.1	7.6	<0.05	23	46	40	1.5	<0.1	0.05	<0.25
17624	Lassell's Br.	@ Rte 2	Ston.	9/7/2011	<4.0	1.1	6.9	<0.05	14	27	16	0.5	<0.1	<0.04	<0.25
17625	Kelly Brook	@ Kelly Road	Ston.	6/22/2011	170	3.1	5.5	<0.05	<10	21	9.3	<0.1	<0.1	0.15	<0.25
17625	Kelly Brook	@ Kelly Road	Ston.	7/20/2011	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
17625	Kelly Brook	@ Kelly Road	Ston.	9/7/2011	<4.0	0.5	5.3	<0.05	<5	18	13	<0.1	<0.1	<0.04	<0.25
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	6/22/2011	20	1.7	6.9	<0.05	10	18	20	0.5	<0.1	0.05	<0.25
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	6/22 DUP	10	1.3	6.9	<0.05	10	18	20	0.5	<0.1	<0.04	<0.25
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	7/20/2011	<4.0	0.79	7.2	<0.05	11	19	20	0.6	<0.1	<0.04	<0.25
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	9/7/2011	61	1.9	6.8	<0.05	10	16	17	0.3	<0.1	0.04	<0.25
17627	Hyde Brook	@Stillman Ave	Ston.	6/22/2011	10	1.4	7.3	0.06	23	35	34	0.3	<0.1	0.04	<0.25
17627	Hyde Brook	@Stillman Ave	Ston.	7/20/2011	<4.0	0.95	7.6	<0.05	26	35	37	0.2	<0.1	<0.04	<0.25
17627	Hyde Brook	@Stillman Ave	Ston.	9/7/2011	<4.0	1.1	7.1	<0.05	17	30	23	<0.1	<0.1	0.06	<0.25

Sta. ID #	Site	Landmark	Town	Date	TSS mg/L	Turb.	pH Units	NH4 mg/L	Alk. mg/L	Hard. mg/L	Chloride mg/L	NO3 mg/L	NO2 mg/L	T Phosphorous mg/L	O-Phosphate mg/L
17628	Pawcatuck River	@ Coggswell St.	Ston.	6/22/2011	<4.0	1.1	6.9	<0.05	10	18	20	0.5	<0.1	<0.04	<0.25
17628	Pawcatuck River	@ Coggswell St.	Ston.	7/20/2011	<4.0	0.76	7.2	<0.05	12	27	42	0.6	<0.1	<0.04	<0.25
17628	Pawcatuck River	@ Coggswell St.	Ston.	9/7/2011	5	1.3	6.8	<0.05	10	17	17	0.3	<0.1	0.04	<0.25
17629	Shunock R.	@ Rte. 49	No Ston	6/22/2011	<4.0	0.7	7.4	<0.05	19	34	19	0.4	<0.1	<0.04	<0.25
17629	Shunock R.	@ Rte. 49	No Ston	7/20/2011	<4.0	0.43	7.4	<0.05	21	35	19	0.3	<0.1	<0.04	<0.25
17629	Shunock R.	@ Rte. 49	No Ston	9/7/2011	5	1.3	7.1	<0.05	15	24	11	0.1	<0.1	<0.04	<0.25
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	6/22/2011	4	1.3	7	<0.05	12	20	20	0.5	<0.1	<0.04	<0.25
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	7/20/2011	<4.0	0.94	7	<0.05	12	20	20	0.5	<0.1	<0.04	<0.25
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	9/7/2011	<4.0	1.3	6.8	<0.05	10	17	17	0.3	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	6/22/2011	<4.0	<0.2	5.9	<0.05	<10	<1	<1	<0.1	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	7/20/2011	<4.0	<0.2	5.5	<0.05	<5	<1	<1	<0.1	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	9/7/2011	<4.0	<0.2	5.6	<0.05	<5	<1	<1	<0.1	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	6/22/2011	<4.0	<0.2	5.9	<0.05	<10	<1	<1	<0.1	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	7/20/2011	<4.0	<0.2	5.5	<0.05	<5	<1	<1	<0.1	<0.1	<0.04	<0.25
14302	Milli-Q	Field Blank	Htfd	9/7/2011	<4.0	<0.2	5.6	<0.05	<5	<1	<1	<0.1	<0.1	<0.04	<0.25

Table 3B. Freshwater Metals Sampling Results

Sta.					Cd ug/L		T Ch ug/L		Cu ug/L		Ni ug/L		Pb ug/L		Zn ug/L		Hg ug/L	Fe ug/L	Al ug/L		Na
ID #	Site	Landmark	Town	Date	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	mg/L
14379	Pawcatuck River	@White Rock Brdg	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	600	70	100	14
14379	Pawcatuck River	@White Rock Brdg	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	500	50	60	13
14379	Pawcatuck River	@White Rock Brdg	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	660	100	150	11
17617	Pawcatuck River	@ Post Office Rd.	No Ston	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	620	80	110	14
17617	Pawcatuck River	@ Post Office Rd.	No Ston	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	560	60	70	14
17617	Pawcatuck River	@ Post Office Rd.	No Ston	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	610	90	120	12
17619	Lewis Brook	@ Boom Bridge	No Ston	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	710	<50	190	16
17619	Lewis Brook	@ Boom Bridge	No Ston	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	500	<50	90	16
17619	Lewis Brook	@ Boom Bridge	No Ston	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	760	150	290	12
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	600	70	100	14
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	530	60	70	14
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	2	<10	<10	<0.5	870	100	260	12
17620	Pawcatuck River	@ Boombridge Rd.	No Ston	9/7 DUP	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	620	100	150	11
17621	Iron Brook	@ Rte. 49	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	4200	<50	<50	17
17621	Iron Brook	@ Rte. 49	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	7200	<50	<50	16
17621	Iron Brook	@ Rte. 49	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	3200	56	60	14

Sta.					Cd ug/L		T Ch ug/L		Cu ug/L		Ni ug/L		Pb ug/L		Zn ug/L		Hg ug/L	Fe ug/L	Al ug/L		Na
ID #	Site	Landmark	Town	Date	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	mg/L
17622	Pawcatuck River	@ Alice Court	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	580	60	100	14
17622	Pawcatuck River	@ Alice Court	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	510	50	60	14
17622	Pawcatuck River	@ Alice Court	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	620	100	130	10
17623	Pawcatuck River	White Rock Rd., RI	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	590	70	100	14
17623	Pawcatuck River	White Rock Rd., RI	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	520	<50	60	14
17623	Pawcatuck River	White Rock Rd., RI	Ston.	7/20DUP	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	510	<50	60	14
17623	Pawcatuck River	White Rock Rd., RI	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	650	97	150	11
17624	Lassell's Br.	@ Rte 2	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	970	90	330	18
17624	Lassell's Br.	@ Rte 2	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	2	<10	<10	<0.5	920	<50	450	23
17624	Lassell's Br.	@ Rte 2	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	810	200	240	9.8
17625	Kelly Brook	@ Kelly Road	Ston.	6/22/2011	<1	<1	<3	<3	<3	4	<3	<3	4	17	<10	20	<0.5	5100	570	3100	6.9
17625	Kelly Brook	@ Kelly Road	Ston.	7/20/2011	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
17625	Kelly Brook	@ Kelly Road	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	2.7	3	<10	<10	<0.5	1400	430	450	7.2
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	680	60	120	14
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	6/22 DUP	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	810	60	180	14
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	520	<50	60	14
17626	Pawcatuck River	@ Stillman Ave Bridge	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	600	90	140	11

Sta.					Cd ug/L		T Ch ug/L		Cu ug/L		Ni ug/L		Pb ug/L		Zn ug/L		Hg ug/L	Fe ug/L	Al ug/L		Na
ID #	Site	Landmark	Town	Date	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	mg/L
17627	Hyde Brook	@Stillman Ave	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	2	3	<10	<10	<0.5	1000	60	110	21
17627	Hyde Brook	@Stillman Ave	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	200	<50	70	24
17627	Hyde Brook	@Stillman Ave	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	1.1	2	<10	<10	<0.5	880	110	140	13
17628	Pawcatuck River	@ Coggswell St.	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	590	60	100	14
17628	Pawcatuck River	@ Coggswell St.	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	490	<50	60	26
17628	Pawcatuck River	@ Coggswell St.	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	680	94	160	11
17629	Shunock R.	@ Rte. 49	No Ston	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	380	<50	<50	12
17629	Shunock R.	@ Rte. 49	No Ston	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	250	<50	<50	11
17629	Shunock R.	@ Rte. 49	No Ston	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	610	59	110	7.1
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	610	60	100	15
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	530	<50	60	14
17630	Pawcatuck River Canal	White Rock Rd., RI	Ston.	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	640	88	120	11
14302	Milli-Q	Field Blank	Htfd	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1
14302	Milli-Q	Field Blank	Htfd	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1
14302	Milli-Q	Field Blank	Htfd	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1
14302	Milli-Q	Field Blank	Htfd	6/22/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1

Sta.					Cd ug/L		T Ch ug/L		Cu ug/L		Ni ug/L		Pb ug/L		Zn ug/L		Hg ug/L	Fe ug/L	Al ug/L		Na
ID #	Site	Landmark	Town	Date	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	mg/L
14302	Milli-Q	Field Blank	Htfd	7/20/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1
14302	Milli-Q	Field Blank	Htfd	9/7/2011	<1	<1	<3	<3	<3	<3	<3	<3	<1	<1	<10	<10	<0.5	<40	<50	<50	<1

APPENDIX 4. SALTWATER CHEMISTRY RESULTS FROM TARGETED SAMPLING EFFORTS

There were two sampling trips conducted in the Pawcatuck River Watershed estuary segments by CT DEEP to collect and analyze samples for general chemistry and metals. Tables 2A and 2B summarize the saltwater results of those collections.

CT DEEP monitoring data from saltwater sampling locations are included below. Most of the data doesn't indicate any impairments or water quality issues as the results are below the detection limit for the test conducted on the sample. There are a few exceptions to this statement where the results not only are detectable but also exceed water quality criteria. Those stations have been highlighted in the following tables. The yellow highlighted value shows an exceedance of the CT Water Quality standards acute value of 4.8 µg/L for copper. There are red highlights of data points that exceed the chronic CT Water Quality Standards of 87 µg/L for aluminum. The magenta highlights indicate an exceedance of the acute NOAA SQuiRTs screening values for iron in saltwater of 300 µg/L, there are no CT Water Quality Standards values for iron. For comparisons with CT Water Quality Standards, the dissolved fraction of the metal is the value that has a direct comparison with criteria. If there are no saltwater criteria in the CT Water Quality Standards, freshwater values can be utilized to determine ALUS. Brackish waters should be compared with the more restrictive of freshwater and saltwater criteria.

There is only one exceedance for the copper criteria amongst all data points in the collected information. All other dissolved copper results are below the detection limit for the utilized method. The exceedances for iron and aluminum are much more prevalent in the data set with most stations exhibiting an exceedance during the September and October sampling trips.

Table 4A Saltwater General Chemistry Results

Sta.		TSS	pH	NH4	TKN	Alk.	Hard.	Chloride	NO3	NO2	TDS	T Phosphorus	O-Phosphorus	Cl2	Na
ID	Date	mg/L	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
14302	9/13/2011	<4.0	5.7	<0.05	<0.5	<5	<1	<1.0	<0.1	<0.1	<10	<0.04	<0.25	<50	<1.0
14302	10/6/2011	<4.0	5.7	<0.05	<0.5	<5	<1	<1.0	<0.1	<0.1	<10	<0.04	<0.25	<50	<1.0
17666	9/13/2011	<4.0	6.4	<0.05	<0.5	7	14	18	0.1	<0.1	89	<0.04	<0.25	<50	11
17666	10/6/2011	<4.0	6.8	<0.05	<0.5	9.1	55	94	0.23	<0.1	205	<0.04	<0.25	<50	82
17667	9/13/2011	<4.0	6.5	<0.05	<0.5	8	76	260	0.1	<0.1	570	<0.04	<0.25	<50	120
17667	10/6/2011	<4.0	6.8	<0.05	0.76	9.9	90	265	0.22	<0.1	531	<0.04	<0.25	<50	141
17668	9/13/2011	<4.0	7	<0.05	<0.5	31	140	1280	1.6	<0.1	2600	0.08	<0.25	<50	210
17668	10/6/2011	<4.0	7.1	<0.05	0.72	25	248	821	0.94	<0.1	1640	0.05	<0.25	<50	458
17669	9/13/2011	<4.0	6.7	<0.05	0.5	10	200	600	0.1	<0.1	1200	0.07	<0.25	<50	320
17669	10/6/2011	<4.0	7.1	<0.05	0.74	17	457	1490	0.23	<0.1	2880	<0.04	<0.25	<50	771
17670	9/13/2011	<4.0	6.6	<0.05	<0.5	9	130	390	0.2	<0.1	830	<0.04	<0.25	<50	220

Sta.		TSS	pH	NH4	TKN	Alk.	Hard.	Chloride	NO3	NO2	TDS	T Phosphorus	O-Phosphorus	Cl2	Na
ID	Date	mg/L	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
17670	10/6/2011	<4.0	7.1	<0.05	<0.5	16	477	1400	0.2	<0.1	2760	<0.04	<0.25	<50	490
17671	9/13/2011	<4.0	6.6	<0.05	<0.5	10	180	520	0.1	<0.1	1100	<0.04	<0.25	<50	290
17671	10/6/2011	<4.0	7.1	<0.05	0.63	18	525	1650	0.2	<0.1	3250	<0.04	<0.25	<50	950
17671	10/6Dup	<4.0	7.1	<0.05	<0.5	18	524	1710	0.2	<0.1	3250	<0.04	<0.25	<50	938
17672	9/13/2011	<4.0	6.7	<0.05	<0.5	10	220	630	0.1	<0.1	1300	<0.04	<0.25	<50	360
17672	9/13Dup	<4.0	6.7	<0.05	2.9	10	210	640	0.1	<0.1	1400	<0.04	<0.25	<50	350
17672	10/6/2011	<4.0	7.1	<0.05	0.69	16	407	1270	0.21	<0.1	2470	<0.04	<0.25	<50	730
17673	9/13/2011	<4.0	6.7	<0.05	<0.5	10	210	590	0.1	<0.1	1200	<0.04	<0.25	<50	330
17673	10/6/2011	4	7.1	<0.05	<0.5	18	521	1690	0.2	<0.1	3320	<0.04	<0.25	<50	958
17674	9/13/2011	<4.0	6.7	<0.05	<0.5	11	240	720	0.1	<0.1	1500	<0.04	<0.25	<50	380
17674	10/6/2011	<4.0	7.2	<0.05	<0.5	19	576	1890	0.22	<0.1	3740	<0.04	<0.25	<50	1040
17675	9/13/2011	<4.0	7	<0.05	0.5	16	430	1570	0.1	<0.1	3400	<0.04	<0.25	<50	680
17675	10/6/2011	<4.0	7.4	<0.05	<0.5	34	1410	4450	1.8	<0.2	8480	<0.04	<0.25	<50	2420
17676	9/13/2011	<4.0	7	<0.05	<0.5	17	530	1720	0.1	<0.1	3700	<0.04	<0.25	<50	850
17676	10/6/2011	<4.0	7.3	<0.05	<0.5	27	1050	3260	0.2	<0.1	6260	<0.04	<0.25	<50	1720
17677	9/13/2011	<4.0	7.1	<0.05	<0.5	18	630	2010	0.1	<0.1	4200	<0.04	<0.25	<50	1100
17677	10/6/2011	<4.0	7.4	<0.05	<0.5	30	1320	3910	0.19	<0.2	7210	<0.04	<0.25	<50	2090
17678	9/13/2011	<4.0	7.3	<0.05	<0.5	28	1000	3560	<0.1	<0.1	7700	<0.04	<0.25	<50	1800
17678	10/6/2011	7	7.7	<0.05	<0.5	60	2800	9570	0.12	<0.5	16700	<0.04	<0.25	<50	4570
17679	9/13/2011	<4.0	7.6	<0.05	<0.5	45	1900	6670	<0.1	<0.1	14000	<0.04	<0.25	<50	3400

Table 4B. Saltwater Metals Results

Sta.	.	.	Cd	TCh	Cu	Ni	Pb	Zn	Mn	Fe	Al
ID#	Date	Analysis	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
14302	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<20	<40	<50
14302	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	<20	<40	<50
14302	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	<40	<50

Sta.	.	.	Cd	TCh	Cu	Ni	Pb	Zn	Mn	Fe	Al
ID#	Date	Analysis	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
14302	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	<40	<50
17666	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	46	520	180
17666	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	60	730	210
17666	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	480	120
17666	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	660	150
17667	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	49	500	170
17667	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	700	200
17667	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	460	120
17667	10/6/2011	TOTAL	<1	<3	<3	<3	2.1	<10	<40	620	140
17668	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	49	470	160
17668	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	650	190
17668	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	51	320	75
17668	10/6/2011	TOTAL	<1	<3	4.7	<3	<1	11	60	510	95
17669	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	48	430	150
17669	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	660	190
17669	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	340	96
17669	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	510	120
17670	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	50	480	170
17670	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	670	200
17670	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	350	99
17670	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	590	120
17671	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	47	490	160
17671	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	680	200
17671	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	350	100
17671	10/6/2011	TOTAL	<1	<3	<3	<3	23	15	<40	600	150
17671	10/6Dup	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	330	100
17671	10/6Dup	TOTAL	<1	<3	<3	<3	<1	18	<40	600	130
17672	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	51	450	170

Sta.	.	.	Cd	TCh	Cu	Ni	Pb	Zn	Mn	Fe	Al
ID#	Date	Analysis	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
17672	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	60	680	200
17672	9/13Dup	DISSOLVED	<1	<3	<3	<3	<1	<10	49	460	160
17672	9/13Dup	TOTAL	<1	<3	<3	<3	<1	<10	50	670	210
17672	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	350	100
17672	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	630	140
17673	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	52	450	160
17673	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	60	690	200
17673	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	330	97
17673	10/6/2011	TOTAL	<1	<3	3.7	<3	11	<10	<40	600	130
17674	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	52	490	170
17674	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	640	200
17674	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	310	95
17674	10/6/2011	TOTAL	1.1	<3	<3	<3	40	26	<40	540	130
17675	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	50	420	160
17675	9/13/2011	TOTAL	<1	<3	<3	<3	<1	<10	50	590	190
17675	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	150	72
17675	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	410	96
17676	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	49	360	150
17676	9/13/2011	TOTAL	<5	<15	<5	<15	<5	<50	56	610	190
17676	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	220	85
17676	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	470	110
17677	9/13/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	47	340	140
17677	9/13/2011	TOTAL	<5	<15	<5	<15	<5	<50	56	600	190
17677	10/6/2011	DISSOLVED	<1	<3	<3	<3	<1	<10	<40	180	81
17677	10/6/2011	TOTAL	<1	<3	<3	<3	<1	<10	<40	430	100
17678	9/13/2011	DISSOLVED	<1	<3	<3	<3	<2	<10	44	290	130
17678	9/13/2011	TOTAL	<5	<15	<5	<15	<5	<50	50	490	160
17678	10/6/2011	DISSOLVED	<1	<3	5	<3	<1	<10	<40	<40	52

Sta.	.	.	Cd	TCh	Cu	Ni	Pb	Zn	Mn	Fe	Al
ID#	Date	Analysis	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
17678	10/6/2011	TOTAL	<1	<3	3.7	<3	24	12	<40	180	82
17679	9/13/2011	DISSOLVED	<1	<3	<3	<3	<2	<10	33	52	150
17679	9/13/2011	TOTAL	<5	<15	<5	<15	<5	<50	39	280	130

Appendix 5. Personal Care Products and Pharmaceutical Results

CT DEEP staff collected water samples along the mainstem of the Pawcatuck River and analyzed them for the presence of personal care products and pharmaceuticals (PCPP). This sampling was conducted to evaluate potential sources of bacteria to the river. Many of these chemicals are not found under natural conditions and can act as an indicator of human impacts. Some results, however, such as the presence of cholesterol cannot be definitely traced to a human source without further study as other animals also contribute cholesterol to the environment. PCPP can be utilized to help evaluate illicit connections from homes or businesses to waterbodies, often unbeknownst to the owner. These illicit connections can also be a source of bacteria loading to a waterbody and municipalities often conduct efforts to detect these connections to help implement water quality solutions.

The data set from these sampling efforts is limited in depth and breadth. Most of the results are trace values or at reporting limits. Some of the resulting data may indicate an existence of illicit discharges (eg the results showing presence of caffeine), however, additional sampling is recommended to confirm concentrations and presence. This additional sampling can also help track down sources of the caffeine concentrations.

The results of the CT DEEP sampling efforts are displayed below in table 3A.

Table 5A. PCPP results in the Pawcatuck River

2011 Method ETPH: Caffeine and Pharmaceuticals Results - Pawcatuck River Basin TMDL					
Sta. ID	**Stream**	**Landmark**	**Town**	**9/13/2011**	**10/6/2011**
17617	Pawcatuck R.	@ Post Office Rd.	No. Ston.	0.3 ppb Caffeine Presence of DEET	
17622	Pawcatuck R.	@ Alice Court	Ston.	0.4 ppb Cholesterol Presence of DEET	ETPH <96 Cholesterol-Trace
14379	Pawcatuck R.	@White Rock Bridge	Ston.		ETPH <96 Cholesterol-Trace
17628	Pawcatuck R.	@ Coggswell St.	Ston.	0.170 ppb Caffeine Presence of DEET	ETPH <96 Presence of DEET Cholesterol-Trace
17666	Pawcatuck R.	@ Boat Ramp	Ston.		ETPH <98 Cholesterol-Trace
17668	Pawcatuck R.	@Westerly POTW	Ston.	Unknown aliphatic hydrocarbons	
17671	Pawcatuck R.	@ Pawcatuck POTW	Ston.		ETPH <96 Bisphenol A-Trace
17672	Pawcatuck R.	@ Pump Station-Gavin Is.	Ston.		ETPH <97 Cholesterol-Trace
17674	Pawcatuck R.	Westerly Yacht Club	Ston.		ETPH <97 Bisphenol A-Trace